North American T-2

Airworthiness Certification

AIR-230 Airworthiness Certification Branch
Federal Aviation Administration
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Front Cover Photograph: U.S. Navy.
Back Cover Photograph: FAA.

Introduction – T-2 Airworthiness Certification

This document provides information to assist in the airworthiness certification and safe civil operation of a North American T-2 aircraft.

Attachment 1 provides a general overview of this document. Attachment 2 contains background information on the T-2 aircraft. Attachment 3 lists historic airworthiness issues with the T-2 for consideration in the certification, operation, and maintenance of these aircraft. The list is not exhaustive, but includes our current understanding of risks that should be assessed during in the certification, operation, and maintenance of these aircraft. Concerns regarding particular issues may be mitigated in various ways. Some may be mitigated via the aircraft maintenance manual(s) or the aircraft inspection program. Others may be mitigated via operating procedures i.e., SOPs) and limitations, aircraft flight manual changes, or logbook entries

Not all issues in attachment 3 may apply to a particular aircraft given variations in aircraft configuration, condition, operating environment, or other factors. Similarly, circumstances with an aircraft may raise other issues not addressed by attachment 2 that require mitigation. Attachment 4 includes additional resources and references. Attachment 5 provides some relevant T-2 accident and incident data.

Attachment 1 – Overview of this Document

Purpose

This document is to provide all those involved in the certification, operation, and maintenance of the North American T-2 aircraft with safety information and guidance to help assess and mitigate safety hazards for the aircraft. The existing certification procedures in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products, do not account for many of the known safety concerns and risk factors associated with many high-performance former military aircraft. These safety concerns and risk factors associated with many high performance former military aircraft include—

- Lack of consideration of inherent and known design failures;
- Several single-point failures;
- Lack of consideration for operational experience, including accident data and trends;
- Operations outside the scope of the civil airworthiness certificate;
- Insufficient flight test requirements;
- Unsafe and untested modifications;
- Operations over populated areas (the safety of the non-participating public has not been properly addressed in many cases);
- Operations from unsuitable airports (i.e., short runways, Part 139 (commercial) airports);
- High-risk passenger carrying activities taking place;
- Ejection seat safety and operations not adequately addressed;
- Weak maintenance practices to address low reliability of aircraft systems and engines;
- Insufficient inspection schedules and procedures;
- Limited pilot qualifications, proficiency, and currency;
- Weapon-capable aircraft not being properly demilitarized, resulting in unsafe conditions;
- Accidents and serious incidents not being reported; and
- Inadequate accident investigation data.

Research of T-2 Safety Data

The aircraft, relevant processes, and safety data are thoroughly researched and assessed. This includes—

- Aviation Safety (AVS) Safety Management System (SMS) policy and guidance;
- Historical military accident/incident data and operational history;
- Civil accident data;
- Safety risk factors;
- Interested parties and stakeholders (participating public, non-participating public, associations, service providers, air show performers, flying museums, government service providers, airport owners and operators, many FAA lines of business, and other U.S. Government entities);

- Manufacturing and maintenance implications; and
- Design features of the aircraft.

This Document

The document is a compilation of known safety issues and risk factors identified from the above research that are relevant to civil operations. This document is organized into four major sections:

- General airworthiness issues (grey section),
- Maintenance (yellow section),
- Operations (green section), and
- Risk management, standard operating procedures and best practices (blue section).

This document also provides background information on the aircraft and an extensive listing of resources and references.

How to Use the Document

This document was originally drafted as job aids intended to assist FAA field office personnel and operators in the airworthiness certification of these aircraft. As such, some of the phrasing implies guidance to FAA certification personnel. The job aids were intended to be used during the airworthiness certification process to help identify any issues that may hinder the safe certification, maintenance, or operation of the aircraft. The person performing the certification and the applicant would to discuss the items in the job aid, inspect documents/records/aircraft, and mitigate any issues. This information would be used to draft appropriate operating limitations, update the aircraft inspection program, and assist in the formulation of adequate operating procedures. There are also references to requesting information from, or providing information to the person applying for an airworthiness certificate. We are releasing this document as drafted, with no further updates and revisions, for the sole purpose of communicating safety information to those involved in the certification, operation, and maintenance of these aircraft. The identified safety issues and recommended mitigation strategies are clear and can be considered as part of the certification, operation, and maintenance of the air aircraft.

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Attachment 2 – Background Information on the North American T-2 Aircraft

The first version of the North American T-2 Aircraft entered service in 1959 as the T2J-1. It was re-designated the T-2A in 1962 under the joint aircraft designation system. The two-seat trainer was powered by one Westinghouse J34-WE-46/48 turbojet. The aircraft was subsequently redesigned, and the single engine was replaced with two Pratt & Whitney J60-P-6 turbojets in the T-2B. The T-2C was fitted with two much more powerful 2,950 lb thrust General Electric J85-GE-4 turbojets. The T-2D was an export version which was sold to the Venezuelan Air Force, while the T-2E was sold to the Greek Air Force. The T-2 Buckeye (along with the TF-9J) replaced the Lockheed T2V-1/T-1A, though the T-1 would continue in some uses into the 1970s.

U.S. Navy T-2 at NAS Patuxent River, 1999. Source: FAA.

The Buckeye was designed as a low-cost multi-stage trainer. Its straight wing is similar to that used in the original North American FJ-1 Fury, and its cockpit controls are similar to the T-28C trainer. The T-2's performance is between that of the Air Force's T-37 and the TA-4 Skyhawk. While it has no built-in armament, the T-2 has two under-wing hard points for .50 in gun pods, 100 lb practice bombs, or 2.75 in rockets. It also includes a ranging radar, gun sight, and fire control system. All T-2 Buckeyes were manufactured by North American at Air Force Plant 85 in Columbus, Ohio. A total of 609 T-2s were built.

The T-2 was an important aircraft in naval aviation. Every jet-qualified Naval Aviator and virtually every Naval Flight Officer from the late 1950s until 2004 received training in the T-2 Buckeye, a length of service spanning four decades. In the Naval Aviator and the Naval Flight Officer strike and strike fighter pipeline, the T-2 has been replaced by the near-sonic T-45 Goshawk (the U.S. Navy version of the BAE Hawk), which is more comparable to other high-performance subsonic trainers or the supersonic USAF T-38 Talon. The U.S. Navy officially retired the T-2 in August 2008, after 49 years of service. Several T-2 Buckeyes are now registered in civilian markings and regularly appear at air shows. Some are also used for flight training, air racing, and military support missions. Unlike many other former military aircraft of an earlier vintage, the T-2 was not surplused by the U.S. Navy, and retired aircraft are in storage with the 309th Aerospace Maintenance and Regeneration Group at Davis-Monthan Air Force Base.

T-2 Variants

T-2A: Two-seat intermediate jet training aircraft, powered by a single 3,400-lb thrust Westinghouse J34-WE-46/48 turbojet. Original designation T2J-1 Buckeye. 217 built.

YT-2B: Two T-2As were converted into T-2B prototype aircraft.

T-2B: Improved version, powered by two 3,000-lb thrust Pratt & Whitney J60-P-1 turbojets. 97 built.

YT-2C: One T-2B was converted into a T-2C prototype aircraft.

T-2C: Final production version for the U.S. Navy, powered by two 2,950-lb thrust General Electric J85-GE-4 turbojets. 231 built.

DT-2: Small numbers of T-2Bs and T-2Cs were converted into drone directors.

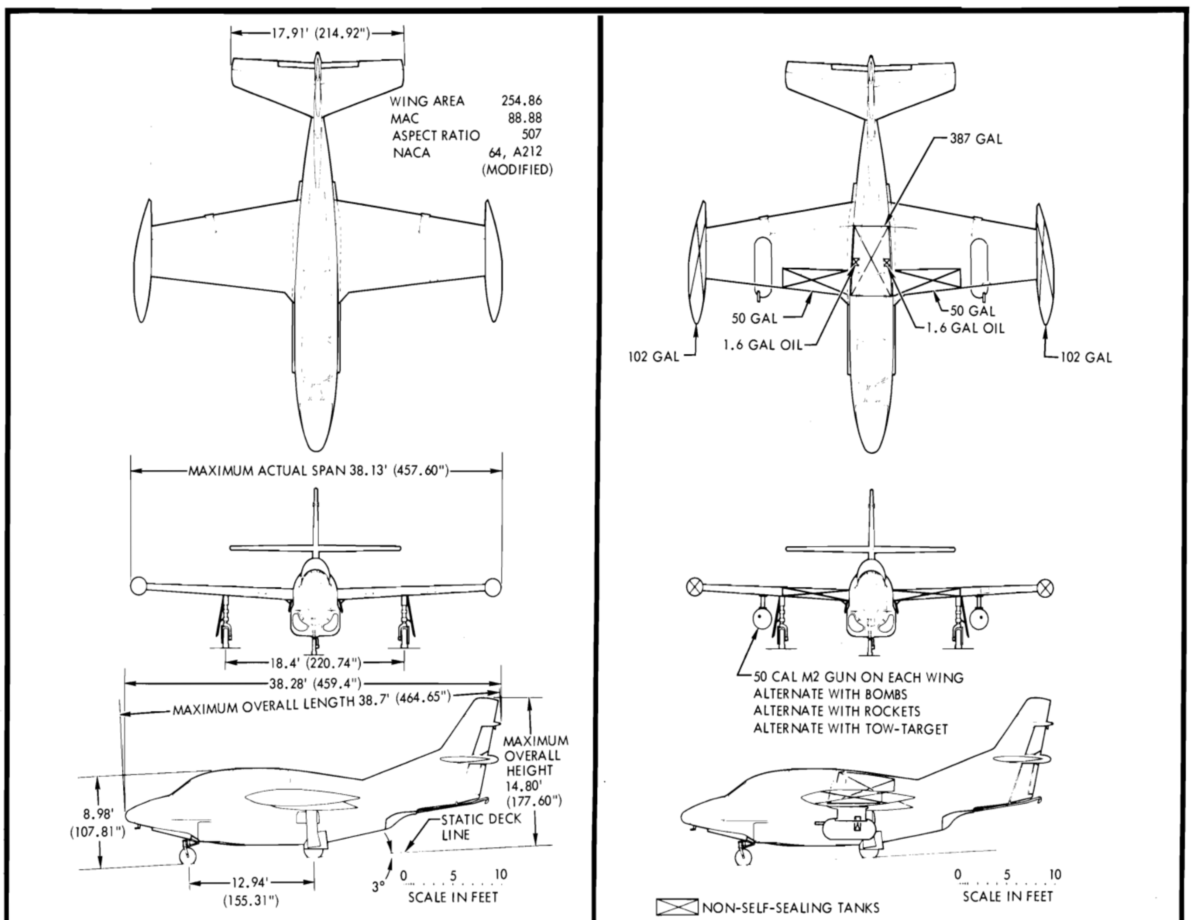
T-2D: Export version for Venezuela. 24 built.

T-2E: Export version for Greece. 40 built.

Cockpit view of a civilian-owned T-2 operating in the United States. Source: FAA.

Specifications T-2C

DIMENSIONS	• **Span: 38.13 ft** • **Length: 38.70 ft** • **Height: 14.80 ft**
WEIGHT	• **Empty: 8,115 lb** • **Takeoff gross weight: 13,179 lb**
MAXIMUM SPEED (SL)	• **465 knots**
SERVICE CEILING	• **45,200 ft**
CREW	• **Instructor pilot, student pilot**
FUEL	• **Fuselage tank: 387 gallons** • **Wing tip tanks: 102 gallons each tank** • **Wing leading edge: 50 gallons each wing**
RANGE	• **930 nm (10 percent reserve)**
EQUIPMENT	• **LS-1A ejection seats** • **Speed brakes** • **Duplicate controls and instruments in each cockpit** • **Variety of communication and navigation systems**
POWERPLANT	• **Two J85-GE-4 engines rated at 2,950 lb**



DESCRIPTIVE ARRANGEMENT ARMAMENT & TANKAGE

Two photographs illustrating the operational environment of many North American T-2s. Above, a T-2 is about to experience the high stresses of an arrested landing during carrier qualifications. Below, another T-2 assigned to an Oceana NAS U.S. Navy adversary unit (Aggressor), taking off. Combat air-t-air maneuvering was part of the T-2's mission in this case. Source: U.S. Navy.

Above, a left front view of a T-2C Buckeye aircraft in 1994. The depot is ending its T-2 Standard Depot Level Maintenance (SLDM) program, with the program being shifted to Naval Aviation Depot, Jacksonville, Fla. Below, aerial of a US Navy (USN) T-2 Buckeye, Training Air Wing Six (CTW-6) (TRAWING SIX), NAS Pensacola, Florida (FL), flown by Ensign (Ens.) D. Greg Detwiler, Training Squadron NINETEEN (VT-19) "Frogs", Naval Air Station Meridan, Mississippi, in 1991. Source: http://www.defenseimagery.mil.

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Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
T-2 Preliminary and General Airworthiness Inspection Issues			
1.	Aviation Safety (AVS) Safety Management System (SMS) Guidance	Use the AVS SMS guidance as part of the airworthiness certification process, as it supplements the existing Code of Federal Regulations (CFR). FAA Order VS8000.367 (May 14, 2008) and FAA Order VS8000.369 (September 30, 2008) are the basis for, but not limited to (1) identifying hazards and making or modifying safety risk controls, which are promulgated in the form of regulations, standards, orders, directives, and policies, and (2) issuing certificates. AVS SMS is used to assess, verify, and control risks, and safety risk management is integrated into applicable processes. Appropriate risk controls or other risk management responses are developed and employed operationally. Safety risk management provides for initial and continuing identification of hazards and the analysis and assessment of risk. The FAA provides risk controls through activities such as the promulgation of regulations, standards, orders, directives, advisory circulars (AC), and policies. The safety risk management process (1) describes the system of interest, (2) identifies the hazards, (3) analyzes the risk, (4) assesses the risk, and (5) controls the risk.	
2.	Aircraft Familiarization	Become familiar with the aircraft before initiating the certification process. One of the first steps in any aircraft certification is to be familiar with the aircraft in question, in this case the T-2. Such knowledge, including technical details, is essential in establishing a baseline as the certification process moves forward.	
3.	Preliminary Assessment	If necessary, conduct a preliminary assessment of the aircraft to determine condition and general airworthiness. This may be an issue if there is evidence that the aircraft is not ready for an airworthiness inspection.	
4.	Condition for Safe Operation	This is an initial determination by an FAA inspector that the overall condition of an aircraft is conducive to safe operations. This refers to the condition of the aircraft relative to wear and deterioration. The FAA inspector will make an initial determination as to the overall condition of the aircraft. The aircraft items evaluated depend on information such as aircraft make, model, age, type, completeness of maintenance records of the aircraft, and the overall condition of the aircraft. See *Safety Discretion* below.	
5.	Main Safety Issues	This document addresses the following general safety concerns regarding the T-38: • Lack of consideration of inherent and known design failures; • Lack of consideration for operational experience, including accident data and trends; • Operations outside the scope of the airworthiness certificate being sought; • Insufficient flight test requirements; • Unsafe and untested modifications; • Operations over populated areas (the safety of the non-participating public has not been properly addressed in many cases); • Operations from unsuitable airports; • High-risk passenger carrying activities taking place; • Ejection seat safety and operation not adequately addressed; • Weak maintenance practices to address low reliability of aircraft systems and engines; • Ignoring required inspection schedules and procedures; • Limited pilot qualifications, proficiency, and currency; • Weapon-capable aircraft not being demilitarized, resulting in unsafe conditions; • Extensive brokering; • Extensive use of unqualified Designated Airworthiness Representatives (DAR); • Accidents and serious incidents not being reported; and • Inadequate accident investigation data.	
6.	Denial	The FAA will provide a letter to the applicant stating the reason(s) for denial and, if feasible, identify which steps may be accomplished to meet the certification requirements if the aircraft does not meet the requirements and the special airworthiness certificate is denied. Should this occur, a copy of the denial letter will be attached to FAA Form 8130-6 and forwarded to AFS-750, and made a part of the aircraft's record.	

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7.	Potential Reversion Back to Phase I	Notify the applicant that certain modifications to the aircraft will invalidate Phase II. These include: (a) structural modifications, (b) aerodynamic modifications, including externally mounted equipment except as permitted in the limitations issued, and (c) change of engine make, model, or power rating (thrust or horsepower). The owner/operator may return the aircraft to Phase I to flight test specific items as required. However, major modifications such as those listed above may require new operating limitations. Phase I may have to be expanded as well. In August 2012, the National Transportation Safety Board (NTSB) issued safety recommendations concerning a fatal accident of an experimental high-performance aircraft that had undergone extensive modifications. The NTSB noted "the accident airplane had undergone many structural and flight control modifications that were undocumented and for which no flight testing or analysis had been performed to assess their effects on the airplane's structural strength, performance, or flight characteristics. The investigation determined that some of these modifications had undesirable effects. For example, the use of a single, controllable elevator trim tab (installed on the left elevator) increased the aerodynamic load on the left trim tab (compared to a stock airplane, which has a controllable tab on each elevator). Also, filler material on the elevator trim tabs (both the controllable left tab and the fixed right tab) increased the potential for flutter because it increased the weight of the tabs and moved their center of gravity aft, and modifications to the elevator counterweights and inertia weight made the airplane more sensitive in pitch control. It is likely that, had engineering evaluations and diligent flight testing for the modifications been performed, many of the airplane's undesirable structural and control characteristics could have been identified and corrected." As part of the probable cause, the NTSB stated that "contributing to the accident were the undocumented and untested major modifications to the airplane and the pilot's operation of the airplane in the unique air racing environment without adequate flight testing." As a result of this investigation, the NTSB issued safety recommendations, including requiring "aircraft owners to provide an engineering evaluation that includes flight demonstrations and analysis within the anticipated flight envelope for aircraft with any major modification, such as to the structure or flight controls." Refer to *Modifications* and *Phase I Flight Testing* below.	
8.	Identify T-2 Version and Sub-Variants	Identify the specific T-2 version being certificated, such as T-2A, T-2B, and T-2C. There are major differences among T-2 aircraft, including the engine, that is, J60 or J85. The T-2A is a single-engine while the B and the C are twins. Refer to *T-2A Model* below.	
9.	T-2A Model	Ask the applicant for background information if the aircraft is a T-2A. This is necessary because there is no record that a T-2A is available. If the aircraft is a T-2A, many of the items discussed in this document do not apply, and others not covered by this document may have to be addressed.	
10.	Major Structural Components	Ask the applicant to identify and document the origin, condition, and traceability of major structural components. This may be an issue with the T-2 because the aircraft was not surplused by the U.S. Navy and may have been restored from an accident aircraft or using major subcomponents.	
11.	FAA Form 8100-1	Use FAA Form 8100-1 to document the airworthiness inspection. Using this form facilitates the listing of relevant items to be considered, those items' nomenclature, any reference (that is, NATO manual; FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products; regulations) revision, satisfactory or unsatisfactory notes, and comments. Items to be listed include but are not limited to— 1. FAA Form 8130-6; 2. § 21.193; 3. FAA Form 8050-1; 4. 14 CFR § 45.11(a); 5. FAA Order 8130.2, paragraphs 4002a(7) and (10), 4002b(5), 4002b(6), 4002b(8), 4111c, and 4112a(2); 6. 14 CFR § 91.205; 7. § 91.417(a)(2)(i), airframe records and total time, overhaul; and 8. § 91.411, § 91.413, altimeter, transponder, altitude reporting, static system test.	
12.	Aircraft Records	Request and review the applicable military and civil aircraft records, including aircraft and engine logbooks.	
13.	PTRS Entries for Malfunctions and Defects Reports	If the applicant reports malfunctions and defects, make a PTRS entry accordingly. See *Reporting Malfunctions and Defects* below.	
14.	Aircraft Ownership	Establish and understand the aircraft's ownership status, which sets the stage for many of the responsibilities associated with operating the aircraft safely. There are many cases where former military aircraft are leased from other entities, and this can cloud the process. For example, if the aircraft is leased, the terms of the lease may be relevant as part of the certification because the lease terms may restrict what can be done to the aircraft and its operation for safety reasons.	
15.	FAA Records Review	Review the existing FAA airworthiness and registration files (EDRS) and search the Program Tracking and Reporting Subsystem (PTRS) for safety issue(s) and incidents.	

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16.	Airframe and Engine Data	Ask applicants to provide the following: Airframe: • Import country (if applicable), • N-Number, • Manufacture year and serial number, and • Airframe time and airframe cycles. Engine: • Type and variant. • Manufacture date and serial number, and • Overhaul data, location, provider, and engine time and cycles. Properly identifying the relevant and basic characteristics of the airframe and the engine are necessary to address the safety issues with the aircraft. The following excerpt from an NTSB report on a former military jet accident illustrates the seriousness of adequate records: “On May 15, 2005, a British Aircraft Corporation 167 Strike Master MK 83, N399WH, registered to DTK Aviation, Inc., collided with a fence during an aborted takeoff from Boca Raton Airport, Boca Raton, Florida. The airplane was substantially damaged and the commercial-rated pilot and passenger sustained minor injuries. The pilot initially stated he performed a preflight inspection of the aircraft which included a flight control continuity check. He had the passenger disable the gust lock for the flight controls. He performed a flight control continuity check before taxiing onto the runway for takeoff; no discrepancies were reported. The takeoff roll commenced and at the calculated rotation speed (70 knots), he ‘...began to apply pressure to stick and noticed an unusual amount of load on the controls. I made a quick trim adjustment to ensure that the forces on the stick were not the results of aerodynamic loads. When the trim changes yielded no change, I initiated an abort (at approximately Vr at 80 knots) by retarding the throttle, extending the speed brakes, and applying the wheel brakes.’ He notified the tower of the situation, briefed the passenger, and raised the flaps. He also opened the canopy after realizing that he was unable to stop on the runway. The airplane traveled off the end of the runway, rolled through a fence and came to rest upright. The pilot also stated that the airplane is kept outside on the ramp at the Boca Raton Airport. Examination of the airplane by an FAA operations inspector before recovery revealed the control column would only move aft between 1/4 and 1/2 inch. No determination was made as to the position of the control lock in the cockpit. Examination of the airplane following recovery by an FAA airworthiness inspector revealed that the elevator was free to travel through the full range but was noted to be ‘...very stiff.’ Additionally, the rudder was ‘...extremely hard to move in either direction.” During movement of the elevator flight control surface, the rudder flight control surface was noted to move, and with movement of the rudder flight control surface, the elevator flight control surface was noted to move. A review of a United Kingdom Civil Aviation Authority (U.K. CAA) Mandatory Permit Directive (MPD) No. 2002-001 R1, issued on January 16, 2003, indicates “partial binding or complete seizure of the elevator/rudder concentric torque tube bearings causing an interconnect between elevator and rudder control systems. This interconnection has resulted in un-commanded rudder movement with the application of elevator control inputs and vice versa. Investigation has determined that bearing seizure was due to inadequate lubrication and water ingress in the elevator torque tube bearings. Aircraft subject to external storage are particularly prone to this occurrence. A review of the airplane maintenance records revealed the airplane was last inspection on June 29,2004, in accordance with, ‘...the scope and detail of the inspection program approved by the FSDO for BAC MK 87 Strikemaster dated June 29, 2001, and found it to be in safe operating condition at this time.’ The logbook entry does not indicate airplane total time; therefore, the time since the inspection was not determined. There was no record that U.K. CAA MPD No. 2002-001 R1 had been complied with.”	

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17.	T-2 OPNAV Aircraft Records	Request and review the applicable OPNAV Navy aircraft records (including the aircraft and engine logbooks) for the T-2 aircraft. The aircraft logbook provides a complete history of aircraft inspection, flight hours flown, modification, and major aircraft repairs. The logs and records for an aircraft were transferred with the aircraft. The logs and records for a special category aircraft are preserved at the Washington National Records Center at the National Archives. The maintenance officer of the station or unit to which an aircraft was assigned oversaw aircraft logbook entries. Monthly flight operational data was recorded on the monthly Flight Summary record. Phase inspections were logged in the periodic inspection record. When a phase inspection was recorded on the inspection record, flight time and the type of phase inspection were entered. When a component was removed from the aircraft or equipment, the card record accompanied the component. The weight and balance system provided a standard system of weight and balance control of the aircraft. The aircraft records will provide an excellent baseline for any inspection. The OPNAV records include— • **Monthly Flight Summary (OPNAV 4790/21A):** This form is designed to permit the monthly compilation of significant flight operational data throughout the service life of the aircraft. It would include all monthly totals before the aircraft is inducted into rework. • **Inspection Record (OPNAV 4790/22A):** These records periodic and conditional inspections performed on the aircraft. Routine turnaround, daily servicing, engine wash, and oil sampling are not logged in any logbook. • **Miscellaneous History (OPNAV 4790/25A):** This section of the logbook is used by operating activities to record significant information that affects the aircraft for which no other space is provided in the logbook. Examples of such information include: Abnormal flight characteristics, peculiar troubles of an undetermined nature, damage to the aircraft, major component changes not logged elsewhere, instances of aircraft or equipment exposure to large quantities of salt water, fire extinguishing agents, or other corrosive elements. • **Structural Life Limits (OPNAV 4790/142):** This form is used to maintain a current record of aircraft structural life-limited components designated for depot-level replacement. These components, with their respective life limits, are listed, in part, in Fixed Wing Aircraft Structural Life Limits, NAVAIRINST 13120.1. • **Assembly Service Record (ASR) (OPNAV 4790/106A):** This provides data tracking on assemblies and subassemblies that have rework or overhaul life limits and are designated to be removed at organizational, intermediate, or depot-level maintenance activities, and discarded. • **Installed Explosive Device Record (OPNAV 4790/26A):** This contains a record of all explosive devices currently installed in the aircraft. These include, but are not limited to, lap belt cartridges, initiators, canopy release, and seat ejection cartridges or devices. • **Equipment History Record Card (OPNAV 4790/113):** This provides a method of monitoring specific maintenance data on maintenance engineering field activity. It also tracks maintenance data for equipment that does not qualify as an SRC (SCHEDULED REMOVAL COMPONENT) card item. Quick engine change kits are examples of such card equipment. • **Scheduled Removal Component Card (OPNAV 4790/28A):** The complete maintenance history, installation, and usage data for all items designated as scheduled removal components are recorded here. The card is also used to record the maintenance history on any item that requires monitoring, tracking, and trending of failure data. • **Aviation Life Support System (ALSS) History Records:** This section of the aircraft logbook contains a file of all aircraft-installed ALSS history records, excluding aircraft equipped with ejection seats. When an aircraft has ejection seats, the records will be inserted into the appropriate ejection seat section. • **Parachute Record (OPNAV 4790/101):** This keeps track of the current configuration and inspection record of a parachute assembly and its components throughout the service life of the equipment. • **Aircrew Systems Record (OPNAV 4790/138):** This provides a continuous configuration and inspection history of ALSS components, kits, and assemblies. • **Aircrew Personal Equipment Record (OPNAV 4790/159):** This record provides a record of the current configuration of all personal equipment issued to aircrewmen.	
18.	Functionality Check	Ask the applicant to prepare the aircraft for flight, including all preflight tasks, startup, run-up, and taxi.	

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19.	Adequate T-2 Manuals and Related Documentation	Ensure the existence of a complete set of the applicable NAVAIR manuals, such as flight manuals, inspections and maintenance manuals, and engine manuals. An operator also needs to have the applicable technical orders (TO) to address known issues related to airworthiness, maintenance, and servicing. Relevant T-2 manuals include— • *NATOPS Flight Manual for the T-2C, NAVAIR 01-60GAB-1.* • *NATOPS Flight Manual for the T-2B, NAVWEPS 01-60GAB-1.* • *NATOPS Pilot's Pocket Checklist T-2B/T-2C Aircraft.* • *NAVAIR 00-110AT2-2 Standard Aircraft Characteristics Navy Model T-2B Aircraft.* • *NAVAIR -6-3 Technical Manual daily/Servicing/Special/Conditional Preservation/ASPA Maintenance Requirements Model T-2C.* • *NAVAIR 01-60GAB-1B Checklist.* • *T-2 Airframe, NAVAIR 01-60GAB-2-2.* • *T-2 Wiring Data, NAVAIR 01-60GAB-2-9.* • *T-2 Airframes, NAVAIR 01-60GAB-4-8.* • *T-2 All Attitude and Angle-Of-Attack Systems, NAVAIR 01-60GAB-2-7.1.* • *T-2 Armament Systems, NAVAIR 01-60GAB-2-6.* • *T-2 Canopy and Survival Systems, NAVAIR 01-60GAB-2-2.4.* • *T-2 Corrosion Control, Cleaning, Painting, NAVAIR 01-60GAB-2-1.1.* • *T-2 Electrical Power Systems and Lighting Provisions, NAVAIR 01-60GAB-2-8.* • *T-2 Flight Control Surfaces and Systems, NAVAIR 01-60GAB-2-2.1.* • *T-2 Fuel System, NAVAIR 01-60GAB-2-4.1.* • *T-2 Power Plant, NAVAIR 01-60GAB-2-4.* • *T-2 Personnel Environnemental Systems, NAVAIR 01-60GAB-2-2.3.* • *T-2 Electrical Power and Electronics, NAVAIR 01-60GAB-4-5.* • *T-2 Ejection System, Air Conditioning and Cockpit Equipment, NAVAIR 01-60GAB-4-6.* • *T-2 Flight Controls, NAVAIR 01-60GAB-4-3.* • *T-2 Fuel and Power Plant, NAVAIR 01-60GAB-4-2.* • *T-2 Hydraulic Power, Landing and Arresting Gear, NAVAIR 01-60GAB-4-4.* • *T-2 Special Support Equipment, NAVAIR 01-60GAB-4-9.* • *T-2 General Information and Servicing, NAVAIR 01-60GAB-2-1.* • *T-2 Hydraulic Power Systems, NAVAIR 01-60GAB-2-3.* • *T-2 Structural Repair Manual, NAVAIR 01-60GAB-3.* • *T-2 Landing Gear, Arresting Gear, NAVAIR 01-60GAB-2-2.2.* • *Fixed Wing Aircraft Structural Life Limits, NAVAIRINST 13120.1.* • *Engine (J60 and J85 powerplant) and accessories manuals and references.*	
20.	Availability of Documents Listed in the Applicable Aircraft List of Applicable Publication Manual	Review the aircraft inspection program (AIP) to verify compliance with the applicable version of T-2 aircraft list of applicable publication manuals or equivalent document. This document should contain the complete listing of all applicable and current NAVAIR technical guidance. Verify the applicant has these documents.	
21.	Applicant/Operator Capabilities	Review the applicant/operator's capabilities, general condition of working/storage areas, availability of spare parts, and equipment.	
22.	Limiting Duration of Certificate	Refer to § 21.181 and FAA Order 8130.2, regarding the duration of certificates, which may be limited. An example would be to permit operations for a period of time to allow the implementation of a corrective action or changes in limitations. In addition, an ASI may limit the duration if there is evidence additional operational requirements may be needed at a later date.	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
23.	Scope and Qualifications for Restoration, Repairs, or Maintenance	Become familiar with the scope of the restoration, repairs, and maintenance conducted by or for the applicant. The following is a sample of some of the major tasks that could be accomplished as part of a T-2 restoration: • Complete records for all parts and assemblies included with purchase orders and vender identification. • All required NAVAIR overhaul and assembly technical library. • All unnecessary military equipment removed pursuant to FAA regulations and to reduce the empty weight of the aircraft. • NDT and visual inspections per North American/Navy Maintenance procedures and current day best practices. • Wing, Fuselage and tail attachment bolts and bushings replaced with new hardware. • All hydraulic components overhauled/bench tested. Aluminum fittings and lines replaced with stainless steel. • All screws and fasteners cad plated or stainless steel. • Electrical System-Aircraft 100 percent rewired per NAVAIR electrical schematics. Fuse panels replaced with new circuit breakers. • All weapons system electrical components removed. • Fuel System-all components overhauled/tested or replaced. Integral wing tanks, pressurized, and leak tested. New fuel lines were installed. • Complete Landing Gear overhaul including NDT of wheels and axels. New wheel bearings installed, new tires. New brake pucks. • Complete cockpit refurbishment and detailing. • All warning lights, switch nomenclature, and required placards remarked with original silkscreen backlit panels. • Paint: Complete strip, etch, prime and paint. • Significant inventory of spares, including (3) J65 engines with log books, new tires and hardware.	
24.	Compliance with § 91.319(a)(1)	Inform the operator that the aircraft are limited under this regulation. The aircraft cannot be operated for any purpose other than the purpose for which the certificate was issued. For example, in the case of an experimental exhibition certificate, the certificate can be used for air show demonstrations, proficiency flights, and flights to and from locations where the maintenance can be performed. Such a certificate is NOT IN EFFECT for flights related to providing military services (that is, air-to-air gunnery, target towing, ECM simulation, cruise missile simulation, and air refueling). Also refer to *Military/Public Aircraft Operations* below.	
25.	Multiple Certificates	Ensure the applicant submits information describing how the aircraft configuration is changed from one to the other in those cases involving multiple airworthiness certificates. This is important because, for example, some research and development (R&D) activities may involve equipment that must be removed to revert back to the Exhibition configuration (refer to *R&D Airworthiness Certification* below). Moreover, the procedures should provide for any additional requirements, such as additional inspections, to address situations such as high-G maneuvering that could impact the aircraft and/or its operating limitations. Similarly, it should address removing R&D equipment that could be considered part of a weapon system (refer to *Demilitarization* below). All applications for an R&D certificate must adhere to FAA Order 8130.29, Issuance of a Special Airworthiness Certificate for Show Compliance and/or Research and Development Flight Testing.	
26.	Public Aircraft Operations, State Aircraft Operations, Military Support Missions, and DOD Contracts	The special airworthiness certificate and attached operating limitations for this aircraft are not in effect during public aircraft operations as defined by U.S. Code reference. They are also not in effect during state aircraft operations (typically military support missions and military contracts), as defined by Article 3 of the International Civil Aviation Organization's Convention on International Civil Aviation. *Aircraft used in military services are deemed state aircraft.* Also refer to *Operations Overseas* below.	
27.	Re-Conforming to Civil Certificate	Ensure the aircraft is returned, via an approved, method to the condition and configuration at the time of airworthiness certification before operating under the special airworthiness certificate issued following a public, state, or military aircraft operation. This action must be documented in a log or daily flight sheet. Ensure the applicant submits information describing how the aircraft configuration is changed from public aircraft operations, state aircraft, or other non-civil classification or activity back to a civil certificate. This is important because, for example, some military support activities may involve equipment and maneuvers that must be removed or mitigated to revert back to original Exhibition or R&D configuration. Moreover, the procedures should provide for any additional requirement(s), such as additional inspections, to address situations such as high-G maneuvering and sustained Gs that could have an impact on the aircraft and/or its operating limitations. Similarly, it should address removing equipment that could be considered part of a weapon system (refer to *Demilitarization* below).	

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28.	R&D Airworthiness Certification	Because R&D certification requires a valid project, ensure the applicant provides detailed information such as— • A description of each R&D project providing enough detail to demonstrate it meets the regulatory requirements of §21.191(a); • The length of each project; • The intended aircraft use, including the number of flights and/or flight hours for each project; • Aircraft configuration; • The area of operation for each project; • Coordination with foreign CAA, if applicable; and • Contact information for the person/customer who may be contacted to verify this activity. Note: All applications for an R&D certificate should include review of FAA Order 8130.29.	
29.	Temporary Extensions	This new certification process using an aircraft-specific job aid is being introduced as aircraft are being considered for certification. As a result, the process allows for the field offices to consider temporary extensions of existing airworthiness certificates, as appropriate. This will enable AIR-200 to complete drafting of the aircraft-specific job aid or allow the field inspector(s) and the applicant additional time to complete a full review using the job aid. Field inspectors are cautioned when issuing a temporary extension to ensure any safety issues they believe need to be addressed and corrected are mitigated as part of this process. FAA Headquarters (AIR-200, AFS-800, and AFS-300) will assist if you have any questions concerning any issue affecting the aircraft.	
30.	Safety Discretion	The field inspector may add any requirements necessary for safety. Under existing regulations and polices, FAA field inspectors have discretion to address any safety issue that may be encountered, whether or not it is included in the job aid. Of course, in all cases, there should be justification for adding requirements. In this respect, the job aid provides a certain level of standardization to achieve this, and in addition, AIR-200 is available to coordinate a review (with AFS-800 and AFS-300) of any proposed limitations an inspector may consider adding or changing. 49 U.S.C. § 44704 states that before issuing an airworthiness certificate, the FAA will find the aircraft is in condition for safe operation. In issuing the airworthiness certificate, the FAA may include terms required in the interest of safety. This is supported by case law. 14 CFR § 21.193, *Experimental Certificates: General,* requires information from an applicant, including, “upon inspection of the aircraft, any pertinent information found necessary by the Administrator to safeguard the general public.” 14 CFR § 91.319, *Aircraft Having Experimental Certificates: Operating*, provides “the Administrator may prescribe additional limitations that the Administrator considers necessary, including limitations on the persons that may be carried in the aircraft.” Finally, FAA Order 8130.2, chapter 4, Special Airworthiness Certification, effective April 16, 2011, also states the FAA may impose any additional limitations deemed necessary in the interest of safety.	
31.	Demilitarization	Verify the aircraft has been adequately demilitarized. This aircraft must remain demilitarized for all operations. The T-2 has a secondary mission as light attack. As such, it could be equipped with weapon systems. Removal of the gun alone, for example, does not suffice. Wiring, switches, and other subsystems need to be disabled as well, including the Fire Control System and Master Armament Switch. Weapons and related components in the T-2 include: an armament accessory kit that provides six store stations; GBU-3/A gun pods (50-caliber gun package); Aero 15D bomb rack; Aero 1A subcaliber adapter; A/A37B rack; Rocket packs; AN/AWG-6 fire control system (baggage compartment); Mk. 6 MOD 4 fire control system; Mk. 8 MOD 9 gunsight; AN/APG-30A ranging radar; and ECM pods, chaff, and flare pods. Safety issues with some of these systems may include inadvertent release on the ground and in the air, discharge of flares or chaff (if installed), electrical overloads of the aircraft electric system, danger of inadvertent stores release, structural damage, complex flight limitations, and possible harmful emissions. TO 00-80G-1, Make Safe Procedures for Public Static Display, dated November 30, 2002, can also be used as a reference.	
32.	Ex-Venezuelan Air Force T-2Ds	Ask whether the aircraft is an ex-Venezuelan Air Force T-2. This is relevant because the T-2D in Venezuelan Air Force service was plagued by a chronic lack of spares support and this affected their airworthiness then and possibly now.	
33.	2009 Crash of ZU-BEX	Recommend the accident report concerning the 2009 Lightning T5 ZU-BEX be reviewed in detail. This report, published by the South African CAA in August 2012, provides valuable insight into the consequences of operating complex and high-performance former military aircraft in an unsafe manner. The relevant issues identified in the report include (1) ignoring operational history and accident data, (2) inadequate maintenance practices, (3) granting extensions on inspections, (4) inadequate operational procedures, and (5) inadequate safety oversight. Many of the issues discussed and documented in the accident investigation report are directly relevant to safety topics discussed in this T-2 document. The South African CAA report can be found at http://www.caa.co.za/.	

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34.	Importation	Review any related documents from U.S. Customs and Border Protection and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) for the aircraft. If the aircraft was not imported as an aircraft, or if the aircraft configuration is not as stated in Form ATF-6, it may not be eligible for an airworthiness certificate. There are many cases in which Federal authorities have questioned the origin of a former military aircraft and its installed weapon system. Some have been seized. For example, two T-2Bs were seized at the Canadian border by U.S. Customs officials in 1989. Refer to *Federal Firearms Regulations Reference Guide*, ATF Publication 5300.4, Revised September 2005, for additional guidance.	
35.	Restrictions on Operations Overseas	Inform the applicant/operator that operations may be restricted and permission must be granted by a foreign CAA. The applicable CAA may impose any additional limitations it deems necessary, and may expand upon the restrictions imposed by the FAA on the aircraft. In line with existing protocols, the FAA will provide the foreign CAA any information, including safety information, for consideration in evaluating whether to permit the operation of the aircraft in their country, and if so, under what conditions and/or restrictions. It is also noted any operator offering to use a U.S. civil aircraft with an experimental certificate to conduct operations such as air-to-air combat simulations, ECM, target towing for aerial gunnery, and/or dropping simulated ordinances pursuant to a contract or other agreement with a foreign government or other foreign entity would not be doing so in accordance with any authority granted by the FAA as the State of Registry or State of the Operator. On the issue of operations overseas: ➢ Under international law, the aircraft will either be operated as a civil aircraft or a state aircraft. The aircraft cannot have a combined status. If the aircraft are to be operated with civil status, then they must have FAA-issued airworthiness certificates. If the applicant/operator is seeking experimental certificates for R&D or Exhibition purposes for the aircraft, and if the FAA issues (or renews) those certificates for the aircraft, then the only permissible operation of the aircraft as civil aircraft in a foreign country, is for an R&D or Exhibition purpose. The applicant/operator cannot be allowed to accomplish other purposes during the same operation, such as performing the contract for a foreign air force. This position is necessary to avoid telling an operator that any R&D or Exhibition activity could serve as a cover for a whole host of improper activities using an aircraft with an experimental certificate for R&D or Exhibition purposes, rendering the R&D or Exhibition limitation on the certificate meaningless. ➢ The R&D or Exhibition activity would be a pretext for the real purpose of the operation. Accordingly, in issuing experimental certificates for an R&D or Exhibition purpose, the FAA must make it clear that any other activities or purposes for the operation are outside the scope of permitted operations under the certificate. The FAA must also make clear that the operation as a civil aircraft requires the permission of the foreign civil aviation authority (CAA). In requesting that permission, the applicant/operator should advise the foreign aviation authority that the operation will be for an R&D or Exhibition purpose only and for no other purpose, including performing a contract for any foreign military organization. ➢ The applicant/operator must understand that if the foreign CAA asks FAA about the operation, the FAA will state "that the only permissible purpose of the operation is R&D or Exhibition, and an operation for any other purpose, even when conducted in conjunction with an R&D or Exhibition purpose, is outside the scope of the operations allowed under the certificate. ➢ If the applicant/operator operates the aircraft as state aircraft, then the national government of some country will have designated the aircraft as its state aircraft, and the host country, will have given the aircraft permission to operate through the issuance of a diplomatic clearance. That diplomatic clearance should include whatever terms and conditions that CAA deems necessary or appropriate for the operation. ➢ The aircraft, when operated as state aircraft, does not need an FAA airworthiness certificate, and the pilots of those aircraft do not need to hold FAA-issued airman licenses. Safety oversight responsibility for aircraft designated as state aircraft rests with the country that made the state aircraft designation.	
36.	Brokering	Verify the application for airworthiness does not constitute brokering. Section 21.191(d) was not intended to allow for the brokering or marketing of experimental aircraft. This includes individuals who manufacture, import, or assemble aircraft, and then apply for and receive experimental exhibition airworthiness certificates so they can sell the aircraft to buyers. Section 21.191(d) only provides for the exhibition of an aircraft's flight capabilities, performance, or unusual characteristics at air shows, and for motion picture, television, and similar productions. Certificating offices must verify all applications for exhibition airworthiness certificates are for the purposes specified under § 21.191(d) and are from the registered owners who will exhibit the aircraft for those purposes. Applicants must also provide the applicable information specified in § 21.193.	

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37.	Federally Obligated Airport Access	Inform the operator T-2 operations may be restricted by airports because of safety considerations. As provided by Title 49 of the United States Code (U.S.C.) § 47107(a), a federally obligated airport may prohibit or limit any given type, kind, or class of aeronautical use of the airport if such action is necessary for the safe operation of the airport or necessary to serve the civil aviation needs of the public. Additionally, per FAA Order 5190.6, FAA Airport Compliance Manual, the airport should adopt and enforce adequate rules, regulations, or ordinances as necessary to ensure safety and efficiency of flight operations and to protect the public using the airport. In fact, the prime requirement for local regulations is to control the use of the airport in a manner that will eliminate hazards to aircraft and to people on the ground. In all cases concerning airport access or denial of access, and based on FAA Flight Standards Service safety determination, FAA Airports is the final arbiter regarding aviation safety and will make the determination (Director's Determination, Final Agency Decision) regarding the reasonableness of the actions that restrict, limit, or deny access to the airport (refer to FAA Docket 16-02/08, FAA v. City of Santa Monica, Final Agency Decision; FAA Order 2009-1, July 8, 2009; and FAA Docket 16-06-09, Platinum Aviation and Platinum Jet Center BMI v. Bloomington-Normal Airport Authority).	
38.	Environmental Impact (Noise)	Inform the operator that T-2 operations may be restricted by airport noise access restrictions and noise abatement procedures in accordance with 49 U.S.C. § 47107. As a reference, refer to FAA Order 5190.6. Note: The J85 engines are extremely noisy and this may have implications in terms of airport access and compliance with any FAA-approved noise levels restriction.	
39.	Initial Contact Checklist	The following is a sample of the contents of an initial contact by an FAA field office to an applicant concerning a proposed certification. It addresses many of the major safety and risk issues with the T-2 and will assist in (1) preparing an airworthiness applicant, (2) making corrections and updating any previous application, and (3) documenting the level of airworthiness review. 1. Discuss item missing from the application. a. Program letter setting the purpose for which the aircraft will be used. i. Exhibition of aircraft flight capabilities, performance, unusual characteristics at air shows, motion picture, television and similar productions, and maintenance of exhibition flight proficiency, including flying to and from such air shows and productions. ii. Aircraft cannot be certified if the intention is to broker or sell the aircraft. iii. Aircraft photos. 2. Prepare aircraft and documentation for FAA inspection. a. Maintenance and modification records; aircraft history and logbooks (airframe, engine, and components); b. Have the aircraft maintenance program ready for review and acceptance. c. Have operations and maintenance and supplements; d. Have crew qualifications ready for review (pilot, mechanics, A&P, IA). e. Be prepared to show spare parts records; f. Be prepared to accomplish preflight, ground checks, run-up, and taxi checks. g. Be prepared to demonstrate the aircraft has been demilitarized; Have records on status of ejection seats. h. Be prepared to discuss required ground support equipment and specialized tooling for maintenance. i. Be prepared to discuss and document the airframe fatigue life program compliance. j. Be prepared to discuss engine thrust measurement process. k. Be prepared to demonstrate oxygen system checks. l. If "G" suits are used be prepared to demonstrate serviceability. m. Have records for any fabricated parts and engineering documentation, if required. n. Have records on flight control balancing; o. Have weight and balance records. p. Be prepared to discuss external stores; q. Be prepared to discuss Phase I test flights (recommended 10 hours). r. Have record of installed avionics. 3. Applicable regulations and ACs. a. §§21.93, 21.181, 21.193, 21.191(d), 23.1441, 43.3, 43.9, 45.11, 45.23(b), 45.25, 45.29, 91.205, 91.307, 91.319(a)(1), 91.407, 91.409(f)(4), 91.411, 91.413, 91.417, 91.1037, 91.1109, and AC 43-9, AC 91-79. b. Items to discuss with applicant: (a) Recommendation of establishing a minimum equipment list; (b) recommend establishing minimum pilot experience and proficiency, including (1) FAA PIC policy, NAVAIR training, (2) 10 to 15 hours of dual time, and (3) 3 hours per month, and five takeoffs and landings; (c) recommend establishing minimum runways length criteria for takeoff and landing, and (d) discuss military use, that is, declaration of public use operations (PAO) and operating limitations.	

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T-2 Maintenance Manual(s), Aircraft Inspection Program (AIP), and Servicing			
40.	Changes to AIP	Consider whether the FAA-accepted AIP is subject to revisions to address safety concerns, alterations, or modifications to the aircraft. Section 91.415, Changes to Aircraft Inspection Programs, requires that "whenever the Administrator finds that revisions to an approved aircraft inspection program under § 91.409(f)(4) or § 91.1109 are necessary for the continued adequacy of the program, the owner or operator must, after notification by the Administrator, make any changes in the program found to be necessary by the Administrator." As provided by § 91.415, review the submitted maintenance manual(s) and AIP. Work with the applicant to revise the AIP as needed based on any concerns identified in this table. For example, a T-2 AIP can be modified to address or verify— • Consistency with the applicable military TOs for airframe, powerplant, and systems to verify replacement/interval times are addressed. • All AIP section and subsections include the proper NAVAIR guidance/standards for all systems, groups, and tasks. • No "on condition" for items that have replacement times unless proper technical data to substantiate the change, that is, aileron boost and oxygen regulator. • Ejection seat system replacement times are adhered to. No "on condition" for rocket moors and propellants. Make the distinction between replacement times, that is, "shelf life" vs. "installed life limit." • Any deferred log is related to a listing of minimum equipment for flight. • Inclusion of document revision page(s).	
41.	AIP Is Not a Checklist	Ensure the AIP stresses it is not a checklist. This is important in many cases because the actual AIP is only a simple checklist and actual tasks/log book entries say little of what was actually accomplished and to what standard. This is one of the major issues with some AIPs, and stems from confusion about the different nature of (1) aircraft maintenance manuals, (2) AIPs, and (3) inspection checklists. Unless a task or item points to tech data (not just reference to a manual), it is simply a checklist, not a manual. Ensure the AIP directs the reader to other references such as tech data, including references to sections and pages within a document (and revision level), that is, AC 43-13 p.318 or NAVAIR inspection card 26.2. Records must be presented to verify times on airframe and engines, inspections, overhauls, repairs, and in particular, time-in-service, time remaining, and shelf life on life limited parts. It is the owner's responsibility to ensure these records are accurate. Refer to CJAA Safety Operations Manual, Rev. 6/30/08.	
42.	AIP Limitations	Refrain from assuming compliance with the applicable military standards, procedures, and inspections are sufficient to achieve an acceptable level of safety for civil operations as part of the airworthiness certification and related review of the AIP. This may not be true, depending on the situation and the aircraft. For example, an AIP based on 1978 NAVAIR requirements for the T-2 will not necessarily address the additional concerns or issues 35 years later, such as aging, structural and materials deterioration, stress damage (operations past life limits), extensive uncontrolled storage, new techniques, and new industry standards.	
43.	AIP Revision Records	Ensure the applicant/operator retains a master list of all revisions that can be reviewed in accordance with other dated material that may be required to be done under a given revision. The AIP should address revision history for manual updates and flight log history.	
44.	NAMPSOPS	Recommend the AIP addresses all aspects of the maintenance of the aircraft being certificated and ensures those aspects are accomplished in adherence to the Naval Aviation Maintenance Program Standard Operating Procedures (NAMPSOPs), unless limited otherwise by FAA-issued operating limitations. The NAMPSOPS provide the acceptable maintenance procedures and processes to safely and adequately maintain a T-2.	
45.	Maintenance Responsibilities	The AIP should address responsibilities and functions in a clear manner. The AIP should address the difference between the aircraft owner and operator. The AIP also needs to address any leasing arrangement where maintenance is spilt or otherwise outside of the control of the applicant, i.e., where maintenance is contracted to another party. The AIP should define the person responsible for maintenance. The AIP should address qualifications, and delegations of authority, that is, whether the person responsible for maintenance has inspection authority and airworthiness release authority, or authority to return for service. Whether the person is responsible for inspections and this inspection program is also important. In terms of inspection control and implementation, the AIP should define whether it is a delegation of authority, and if so, what authority is being delegated by the owner and operator. This has been an issue with the NTSB and the CAB before it, since 1957.	
46.	Return to Service	Ensure the AIP clearly defines who can return the aircraft to service and provides the minimum criteria for this authority. Follow the intent and scope of § 43.5, Approval for return to service after maintenance, preventive maintenance, rebuilding, or alteration; and § 43.7, Persons authorized to approve aircraft, airframes, aircraft engines, propellers, appliances, or component parts for return to service after maintenance, preventive maintenance, rebuilding, or alteration.	

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47.	Maintenance Practices	Consider AC 43.13-2, Acceptable Methods, Techniques, and Practices-Aircraft Alterations, and AC 43.13-1, Acceptable Methods, Techniques, and Practices-Aircraft Inspection and Repair, in addition to any guidance provided by the manufacturer/military service(s), to verify safe maintenance practices.	
48.	Qualifications for Inspections	Ensure only FAA-certificated repair stations and FAA-certificated mechanics with appropriate ratings as authorized by § 43.3 perform inspections on the T-2.	
49.	Modifications and Alterations	Verify major alterations do not create an unsafe condition and determine whether new operating limitations will be required within the scope and intent of § 21.93. In addition, the information contained in appendix A to part 43 can be used as an aid. Refer to *Potential Reversion Back to Phase I* above.	
50.	Adequate Maintenance Schedule and Program	Ensure the AIP follows NAVAIR requirements, as appropriate, concerning inspections. Under NAVAIR standards, the proper reference is the most current version of the NAVAIR -6-3 *Technical Manual Daily/Servicing/Special/Conditional Preservation/ASPA Maintenance Requirements Model T-2*. This is important when developing an inspection program under § 91.409. The inspection program must comply with both hourly and calendar inspection schedules. The only modifications to the military AIP should be related to the removal of military equipment and weapons. Deletions should be properly documented and justified. A 100-hour, 12-month inspection program under appendix D to part 43 may not be adequate for an aircraft like the T-2.	
51.	NAVAIR Inspections (General) and Periodic Maintenance Inspection	Ensure the T-2 AIP and maintenance manual(s) are based on NAVAIR requirements. Adopt NAVAIR's inspection program (including methods, techniques, practices, standards for its accomplishment, and inspection intervals) as provided in *TECHNICAL MANUAL-Daily/Servicing Preservation/ASPA Maintenance Requirements Model T-2*, NAVAIR 01-60GAB6-3. This NAVAIR guidance concerning inspections states those "requirements are necessary to assure the aircraft is safe for flight." They include daily, hourly, and calendar inspection requirements for the T-2 hour/calendar inspection programs—not one or the other, but both concurrently. For example, references to only hours (that is, 50 hours, 100 hours) ignore NAVAIR's calendar requirements, that is, 210 day inspection. Therefore, a 100-hour, 12-calendar-month inspection program under part 43, appendix D, is insufficient and does not replace these NAVAIR requirements. The NAVAIR-required T-2 maintenance inspections are necessary for safe flight. Examples could include— • Daily; • Servicing; • Special 7 day; • Special 14 day; • Special 84 day; • Special, 91 day; • Special 210 day; • Special 224 day; • Special 364 day; • Special 420 day; • Special 448 day; • Special 10 hours; • Special 25 hours; • Special 50 hours; • Special 100 hours; • Special 200 hours; • Special 750 hours; • ASPA- Special inspection requirements for preparation of the aircraft evaluation and for restoration to a flight-ready condition; and • Out-of-Phase-Items requiring replacement, inspection, and/or calibration that do not fall within other hourly/calendar inspections.	
52.	Airframe, Engine, and Component Replacement Intervals	Verify compliance with required replacement intervals as outlined in appropriate and most current NAVAIR inspection guidance. If components are not replaced per the military guidance, ask for data to justify extensions. Applicants should establish and record time-in-service for all life-limited components and verify compliance with approved life limits. Set time limits for overrun of intervals and track cycles. Evaluate any overruns of inspection or maintenance intervals.	
53.	Missing Inspection Tasks	Verify the AIP follows NAVAIR requirements in terms of inspection tasks. It is imperative that no inspection tasks required by the military standard are removed. If they are removed, there should be adequate justification, and it cannot be solely cost-related. There have been several cases where an AIP did not conform to the applicable military standard and tasks were removed without adequate justification. Note: Weapons-related items can and should be removed.	

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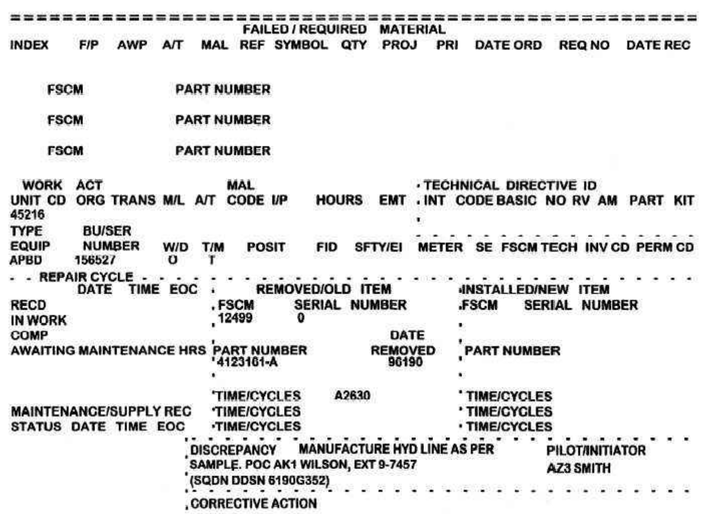
54.	Prioritize Maintenance Actions	Recommend the adoption of a risk management system that reprioritizes high-risk maintenance actions in terms of (a) immediate action, (b) urgent action, and (c) routine action. Also refer to *Recordkeeping, Tracking Discrepancies, and Corrective Action,* below.	
55.	Cannibalization	Cannibalization is a common practice for several former military aircraft operators and service providers. The extent to which it takes place is not necessarily an issue, but keeping adequate records of the transfers, uses, and condition is. In 2001, the U.S. Government Accountability Office (GAO) published its findings on cannibalization of aircraft by the U.S. Department of Defense (DOD). It found cannibalizations have several adverse impacts. They increase maintenance costs by increasing workloads and create unnecessary mechanical problems for maintenance personnel. The GAO also found that with the exception of the Navy, the services do not consistently track the specific reasons for cannibalizations. In addition, a U.S. Navy study found cannibalizations are sometimes done because mechanics are not trained well enough to diagnose problems or because testing equipment is either not available or not working. Because some view cannibalization as a symptom of spare parts shortages, it is not closely analyzed, in that other possible causes or concerted efforts to measure the full extent of the practice are not made.	
56.	Recordkeeping, Tracking Discrepancies, and Corrective Action	Check applicant recordkeeping. Recommend the applicant adopt a system for recording discrepancies and their correction as part of the aircraft's maintenance procedures. The scope and content of §§ 43.9, 43.11, and 91.417 are acceptable. The U.S. Navy's Maintenance Action Form and process will assist with recordkeeping and help verify acceptable levels of continued operational safety for this type of aircraft. Three types of maintenance write-ups should be accounted for: (1) an informational, that is, a general remark about a problem that does not require mitigation; (2) a red slash for a potentially serious problem; and (3) a red "X" highlighting a safety of flight issue that could result in an unsuccessful flight and/or loss of aircraft—no one should fly the aircraft until the issue is fixed. For more information on recordkeeping, refer to AC 43.9, Maintenance Records. In aviation maintenance, good recordkeeping is paramount to proving airworthiness. In addition, and for additional information on NAVAIR's guidance, refer to COMNAVAIRFORINST 4790.2A, *CHAPTER 16 Intermediate Level (I-Level) Maintenance Data System (MDS) Functions, Responsibilities, and Source Document Procedures*, CH-2 10 Nov 2009 and *CHAPTER 10 Naval Aviation Maintenance Program Standard Operating Procedures* or NAMPSOPs.  FAILED / REQUIRED MATERIAL INDEX F/P AWP A/T MAL REF SYMBOL QTY PROJ PRI DATE ORD REQ NO DATE REC FSCM PART NUMBER FSCM PART NUMBER FSCM PART NUMBER WORK UNIT CD 45216 ACT ORG TRANS M/L A/T MAL CODE I/P HOURS EMT TECHNICAL DIRECTIVE ID INT CODE BASIC NO RV AM PART KIT TYPE EQUIP APBD BU/SER NUMBER 156527 W/D O T/M T POSIT FID SFTY/EI METER SE FSCM TECH INV CD PERM CD REPAIR CYCLE DATE TIME EOC REMOVED/OLD ITEM INSTALLED/NEW ITEM RECD IN WORK COMP FSCM 12499 SERIAL NUMBER 0 FSCM SERIAL NUMBER AWAITING MAINTENANCE HRS PART NUMBER 4123161-A DATE REMOVED 96190 PART NUMBER TIME/CYCLES A2630 TIME/CYCLES MAINTENANCE/SUPPLY REC STATUS DATE TIME EOC TIME/CYCLES TIME/CYCLES TIME/CYCLES TIME/CYCLES DISCREPANCY MANUFACTURE HYD LINE AS PER SAMPLE. POC AK1 WILSON, EXT 9-7457 (SQDN DDSN 6190G352) PILOT/INITIATOR AZ3 SMITH CORRECTIVE ACTION Source: U.S. Navy.	
57.	Qualifications of Maintenance Personnel	Check for appropriate qualifications, licensing, and type-specific training of personnel engaged in managing, supervising, and performing aircraft maintenance inspections functions and tasks. The NTSB has found the use of non-certificated mechanics with this type of aircraft has been a contributing factor to accidents. Only FAA-certificated repair stations and FAA-certificated mechanics with appropriate ratings as authorized by § 43.3 perform maintenance inspections on this aircraft.	

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58.	Ground Support, Servicing, and Maintenance Personnel Recurrent Training	Recommend regular refresher training be provided to ground support, servicing, and maintenance personnel concerning the main safety issues surrounding servicing and flight line maintenance of the T-2. Such a process should include a recurrent and regular review of the warnings, cautions, and notes listed in the applicable NAVAIR manuals. Note: Ejection seat safety is paramount.	
59.	NAVAIR LEP (Life Extension Program)	Ask the applicant if a current T-2 NAVAIR Life Extension Program (LEP) has been incorporated into the aircraft. If not, recommended LEP data, namely any structural upgrades, be considered.	
60.	T-2 SLDM	Verify whether the AIP reflects the procedures and processes incorporated into NAVAIR's T-2 Standard Depot Level Maintenance (SLDM) program. If not, recommended that it be incorporated.	
61.	Parts Storage and Management and Traceability	Recommend establishing a parts storage program that includes traceability of parts. This is important in an aircraft like the T-2 which does not benefit from original equipment manufacturer (OEM) support, and general parts availability may be very limited.	
62.	General Guidance on Parts Suitability	Recommend the AIP provide for the evaluation of parts, especially those used for installation on the aircraft. In addition to reviewing applicable records, further evaluation should be performed using the following applicable methods, means, or data sources: 1. If applicable, differences between military and civil version (possible military modification, alteration, and repair performed); 2. Current manufacturer's or military technical data and procedures to perform tests and inspections, including current life-limited parts list; 3. Comparison of military time and/or cycle count for accumulated operational time versus civil; 4. Non-destructive tests, as required; 5. Bench testing or functional test, as required; 6. Results of tests and inspection recorded; 7. Complete historical and modification/alterations/repair records; 8. Manufacturer's identification plate; 9. Flight, maintenance, and/or structural manual(s), and illustrated parts catalog; and 10. Instructions for continued airworthiness.	
63.	Maintenance Records and Use of Tech Data	Conduct a detailed inspection of maintenance records, as required by FAA Order 8130.2. Verify maintenance records reflect inspections, overhauls, repairs, time-in-service on articles, and engines. Ensure all records are current and appropriate technical data is referenced. This should not be a cursory review. Maintenance records are commonly inadequate or incomplete for imported aircraft. Refer to *Adequate T-2 Manuals and Related Documentation* above.	
64.	Airframe Limitation	Verify whether the AIP addresses the T-2 airframe limit, how total time is kept, and the status of any extension. If a determination is made, ensure the proper NAVAIR guidance is used.	
65.	Flight Safety Critical Aircraft Parts	Recommend the T-2 AIP identify all Flight Safety Critical Aircraft Parts (FSCAP). An FSCAP is a part, assembly, or installation containing a critical characteristic, the failure, malfunction, or absence of which could cause a catastrophic failure resulting in loss or serious damage to the aircraft, or an un-commanded engine shutdown resulting in an unsafe condition.	
66.	"On Condition" Inspections	Adhere to NAVAIR's program and/or provide adequate data to justify that practice for the applicable part or component if "on condition" inspections are considered. "On condition" must reference an applicable standard (that is, inspect the fuel pump to an acceptable reference standard, not just "it has been working so far"). Each "on condition" inspection must state acceptable parameters. "On condition" inspections are not appropriate for all parts and components. Acceptable technical data will be required.	
67.	Modifications and Modification State	Ask the applicant to provide data concerning the modification status of the aircraft. The applicant should compare the modification state of the aircraft in question to those required for airworthiness according to the applicable NAVAIR requirements. Refer to *ASC and AFC Compliance*.	

<table>
<tr><th>Issue #</th><th>Issue(s)</th><th>Recommended Review, Action(s), and Coordination with Applicant</th><th>Notes, Action(s) Taken, and Disposition</th></tr>
<tr><td>68.</td><td>NAVAIR Costs of Aging Aircraft Classification</td><td>Recommend the AIP incorporate NAVAIR's cost of aging aircraft classification. This may assist the operator in determining the overall adequacy of the AIP. Using NAVAIR's guidelines, T-2 maintenance costs may vary due to issues such as—

1. Aging system (physical aging of equipment).
• Reaching life limits.
• Increased corrosion.
• Replacement factor for repair parts.
• "Beyond economic repair" items.

2. Obsolescence/vendor base (causes due to aging of component as type).
• Reduced sources/competition.
• Rework vs. replacement of items.
• Premium prices and Cannibalization.

3. New/replacement parts (costs attributed to introduction of new parts): Attrition changes with higher cost materials.

4. Vendor base changes (costs associated with supplier change and changes in vendor sources).

5. Maintenance plan changes (causes due to maintenance changes).
• 3-level to 2-level maintenance.
• Discard vs. repair.
• Increased depth of maintenance.
• Reduction in life limits/increased frequency.

6. Logistics shortfalls (costs due to lack of logistics plan).
• Support equipment/test equipment.
• Repair parts.
• Manpower.
• Publication updates (revisions).

7. Design influences (costs due to design changes).
• Capability growth.
• Design failures.
• Inherent design limitations.

8. Other (not repair process related): budgetary complications, usage issues, mission changes, taxes, data problems.</td><td></td></tr>
</table>

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69.	NAVAIR Aviation Maintenance Best Practices	Recommend the T-2 AIP incorporate NAVAIR's Aviation Maintenance Best Practices, which includes— • Aircraft Engine Turns, • Aircraft Jacking, • Line Division Safety Check-In, • Weekly Checks, • Monthly Checks, • Quarterly Checks, • Aircraft Condition Sign/Checklist, • Aircraft Move Checklist, • Aircraft Director's Checklist, • Maintenance SOP, • ORM Before-and-After Checklist, and • NAVAIR Walk-Through Checklist.	
70.	NAVAIR *ASCs and AFCs*	Verify the AIP specifically accounts for, addresses, and documents the applicable NAVAIR Aircraft Service Changes (ASC) and Airframe Changes (AFC) issued to the T-2 while in service. The T-2 aircraft have been modified by many field changes, which affect operation of the aircraft and equipment. In NAVAIR parlance, field changes are referred to by ASC or AFC number, one of which is assigned to the required modification. Compliance with these is essential for safe operations. An AIP that only references a few such documents issued in 1978, for example, is not adequate. An ASC provides instructions to modify military systems or commodities within specified time limits, initiate special "one-time" inspections, or impose temporary restrictions and track configuration on systems or equipment. ASCs affecting the T-2 may have been issued as late as 2003, with the last operation of a U.S. Navy aircraft. Examples include— • Hydraulic System reservoir pressurization, AFC 155; • Provisions for Selective Refueling Tip Tanks, AFC 132; • Escape System Improvement, AFC 172; • Yaw Damper, AFC 199; and • Improvement of Oil Pressure Line Material and Routing (J60 Only), AFC 160.	
71.	Weapon Systems ASCs and AFCs	Contrary to the many "safety-related" ASCs and AFCs, as discussed in the item above, ASCs and AFCs related to weapon systems CANNOT be installed in the aircraft. These are part of the demilitarization process (refer to *Demilitarization* above).	

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72.	Use of Cycles (General)	Recommend the AIP provides for tracking cycles, such as airframe and engine cycles, in addition to tracking time and in combination with inspections. This allows for the buildup of safety margins and reliability. In military jet aircraft like the T-2, there is a relationship between parts failures, especially as they relate to power plants, landing gears, and other systems, and for that reason it is very important to track airframe and engine cycles between failures and total cycles to build your safety margins on. For example, tracking all aircraft takeoffs for full thrust and de-rated thrust takeoffs as part of the inspection and maintenance program would be a good practice and can assist in building up reliability data. The occurrence of failures can be readily reduced to meaningful statistics, and cycles can play an important role. When rates are used in the analysis, graphic charts (or equivalent displays) can show areas in need of corrective action. Conversely, statistical analysis of inspection findings or other abnormalities related to aircraft/engine check and inspection periods requires judgmental analysis. Therefore, programs encompassing aircraft/engine check or inspection intervals might consider numerical indicators, but sampling inspection and discrepancy analysis would be of more benefit. A data collection system should include a specific flow of information, identity of data sources, and procedures for transmission of data, including use of forms and computer runs. Responsibilities within the operator's organization should be established for each step of data development and processing. Typical sources of performance information are as follows; however, it is not implied that all of these sources need be included in the program, nor does this listing prohibit the use of other sources of information: • Pilot reports, • In-flight engine performance data, • Mechanical interruptions/delays, • Engine shutdowns, • Unscheduled removals, • Confirmed failures, • Functional checks, • Bench checks, • Shop findings, • Sampling inspections, • Inspection write-ups, and • Service difficulty reports.	
73.	Combining Inspection Intervals into One	Set time limits for overrun (flex) of inspection intervals in accordance with NAVAIR guidance.	
74.	Aircraft Storage and Returning the Aircraft to Service After Inactivity	Verify the applicant has a program to address aircraft inactivity and specifies specific maintenance actions for return to service per the applicable T-2 inspection schedule (for example, after 31 days). For example, if the aircraft has not flown in 30 days, a daily inspection schedule may not suffice. The applicable NAVAIR guidance is to be followed. In the U.S. Navy, there are specific maintenance and appropriate functionality check flights to bring a T-2 back to operational use. Refer to NAVAIR 01-60GAB-6-3. The aircraft should be housed in a hangar during maintenance. When the aircraft is parked in the open, it must be protected from the elements, that is, full blanking kit and periodic anti-deterioration checks are to be carried out as weather dictates.	
75.	Specialized Tooling for T-2 Maintenance	Verify adequate tooling, jigs, and instrumentation (as per NAVAIR guidance) are covered in the AIP and used for the required periodic inspections and maintenance per the T-2 maintenance manuals.	

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76.	Technical Directives (TD)	Verify the AIP specifically accounts for, addresses, and documents the applicable TDs issued to the T-2 while in service. TDs affecting the T-2 may have been issued as late as 2008, with the last operation of a U.S. Navy aircraft. The NAVAIR TD system controls and issues all technical directives. This system standardizes the method of issuance for such directives. It is the only authorized means of directing the accomplishment and recording of modifications and one-time inspections of NAVAIR-accepted equipment. There are four TD types: changes, interim changes, bulletins, and rapid action minor engineering changes (RAMEC). A change is a document containing instructions and information that directs the accomplishment and recording of a material change, repositioning, modification, or alteration in the characteristics of the equipment to which it applies. A change directs that parts be added, removed, or changed from the existing configuration, or that parts or material be altered, relocated, or repositioned. Normally, a change is issued as a formal (hard copy) document identified as a Power Plants Change (PPC), AFC (refer to *ASC and AFC Compliance* below), Support Equipment Change, or Airframe Bulletin (AFB) (refer to *NAVAIR AFBs* below) An interim change is a technical directive issued by message or message format letter that dictates urgent dissemination. A bulletin is an interim document comprised of instructions and information that directs a one-time inspection to determine whether a given condition exists. It specifies what action is to be taken if a given condition is found or not found. A RAMEC is a message TD providing for quick action on minor changes that offer significant advantages to the operating forces. The TD system is an important element designed to maintain equipment in a configuration that provides the optimum conditions of safety, operational, and material readiness. If the AIP only makes reference to a few such documents issued in 1978, for example, it would not be adequate. Note: A 1968 RAND Corporation study for the USAF concerning the reliability of USAF complex fighter and bombers aircraft noted that aircraft reliability affecting safety depends, in great part, on performing the comprehensive maintenance and product improvement programs. In other words, and applied to the T-2, any safety baseline requires adherence to the applicable NAVAIR maintenance procedures and requirements as well as ensuring compliance with any improvements over the years, such as those related to the implementation of TDs.	
77.	NAVAIR AFBs	Verify the AIP addresses all current NAVAIR AFBs affecting the T-2.	
78.	Corrosion Due to Age and Inadequate Storage	Evaluate adequacy of corrosion control procedures. Age, condition, and types of materials used in the T-2 may require some form of corrosion inspection control. Ask whether a corrosion control program is in place. If not, ask for steps taken or how it is addressed in the AIP. Recommend the use of TO 1-1-691, Corrosion Prevention and Control Manual.	
79.	Pylons (Structural)	Verify the AIP addresses the inspection of the aircraft's pylons and racks as per the applicable NAVAIR guidance from a structural standpoint, including checking them for cracks.	
80.	J60 and J85 Engine Maintenance Procedures	Verify the AIP adheres to the NAVAIR maintenance procedures requirements as per the applicable version of NAVAIR powerplant manuals for either the J60 or the J85, depending on the version of the aircraft.	
81.	Manufacturer's and/or NAVAIR Engine Modifications	Verify the AIP addresses the incorporation of the manufacturer and NAVAIR modifications to the engine installed. The NTSB and some foreign CAAs have determined a causal factor in some accidents is the failure of some civil operators of former military aircraft to incorporate the manufacturer's recommended modifications to prevent engine failures. This is an important safety item.	
82.	Cycles and Adjustment Engine Replacement Intervals	Ask if both engine cycles and hours are tracked. If not, recommend it be done.	
83.	J60 and J85 Engine Inspections and Time Between Overhaul (TBO)	Verify the applicant has established the proper inspection intervals and TBO/replacement interval for the specific engine type, and adhere to those limitations and replacement intervals for related components. Justification and FAA concurrence is required for an inspection and TBO above those set in the appropriate T-2/engine inspection guidance. Clear data on TBO/time remaining on the engine at time of certification is critical as is documenting those throughout the aircraft life cycle.	
84.	J60/J85 Engine Latest NAVAIR Guidance	Verify the AIP addresses the latest (possibly 2008) NAVAIR guidance concerning the engines.	

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85.	Records Specific to the J60 and J85 Engines Installed in the T-2	Ensure the applicant shows adequate records for the engine installed in the aircraft. Failure to clearly determine this has been linked to accidents. For example, in a 1999 former military aircraft accident, the NTSB noted “according to records, the engine was manufactured in 1954 and sent [into service] as part of a spares contract. The engine was last in the factory overhaul facility on March 26, 1981, for overhaul at 251 hours TSO. The engine is life limited to 450 hours between overhauls. The last manufacturer’s records on this engine documented its installation in another aircraft in 1983, with 392 hours TSO. The operator’s engine maintenance records began on June 27, 1990, and documented its installation in the accident airframe at a maintenance facility in Wisconsin. An unsigned handwritten note preceded this entry and stated the engine had a total run time since overhaul of 436 hours, with 265 hours remaining to overhaul. No documentation was available to support the engine history between leaving RAF service and the installation in the accident airframe. The last entry in the records was dated July 2, 1999, and consisted of an annual inspection at a time of 548 hours since last overhaul.”	
86.	Engine Check	Verify the AIP includes adequate procedures, including checks and sign-offs for returning an aircraft to airworthiness condition after any work on the engine. As an example, as part of its investigation of a fatal former military aircraft accident in 2004, the NTSB found after an engine swap-out the week before the fatal accident, the mechanics had warned the newly installed engine was not operating correctly. The record also shows the A&P mechanic who oversaw and supervised the engine change did not sign off any maintenance records to return the airplane to an airworthy status. Before the fatal flight, two engine acceleration tests failed and multiple aborted takeoffs in the days leading up to the fatal crash took place.	
87.	Engine Thrust	Recommend that the AIP includes measuring actual thrust of the engine and tracking engine operating temperatures.	
88.	Use of Different Fuels	Verify the AIP addresses how the use of different fuels may require changes or additions to the J60 or J85 engine inspection and maintenance programs. Note: NAVAIR guidance makes reference to JP-4 and JP-5. Verify whether JP-8 or other fuels were later authorized by NAVAIR.	
89.	Engine Ground Run	Verify the engine goes through a ground run and check for leaks after reassembly. Confirm it achieves the required revolutions per minute for a given exhaust gas temperature, outside air temperature, and field elevation. There have been cases where aircraft presented for certification did not have records indicating engine testing and functionality.	
90.	Fire Detection System	Verify the serviceability of the fire detection system.	
91.	Servicing, Engine Fire Servicing Personnel Unfamiliar with the T-2 Create Hazardous Situations	Ensure the operator warns servicing personnel via training and markings of the fire hazard of overfilling oil, hydraulic, and fuel tanks. Lack of experience with T-2 servicing is a safety concern (i.e., LOX, arresting hook). Require supervision of servicing operations and fire safety procedures.	
92.	Fire Guard	Verify maintenance, servicing, preflight, and post-flight activities include fire guard precautions. This is standard NAVAIR practice.	
93.	Engine Start	Verify the AIP includes procedures for documenting all unsuccessful starts.	
94.	Engine Storage	Review J60/J85 engine storage methods and determine engine condition after storage. Evaluate calendar time since the last overhaul. For example, the use of a J60 engine with 50 hours since a 1991 overhaul may not be adequate and a new overhaul may be required after a specified time in storage. Note: The FAA’s position on experimental exhibition of former military aircraft is that engines that have exceeded storage life limits are susceptible to internal corrosion, deterioration of seals and coatings, and breakdown of engine preservation lubricants.	
95.	Engine Foreign Object Damage (FOD)	Verify adoption of an FOD prevention program (internal engine section, external, and air intake). Use and properly inspect the air intake screen (FOD guards) provided with the aircraft and designed for the T-2. In the T-2, the FOD guards or screens extend to protect the intakes when the aircraft is on the ground. They retract externally when in flight, and thus their condition (preventing in-flight separation) is important.	

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96.	Engine Condition Monitoring (Oil Analysis)	As part of the engine maintenance schedule, recommend an engine Spectrographic Oil Analysis Program (SOAP) be implemented with intervals of less than 15 hours. If baseline data exists, this can be very useful for failure prevention. If manufacturer baseline data does not exist, this may still warn of impending failure. For the latest guidance on SOAPs affecting the J60 and the J85, refer to Joint Oil Analysis Program Manual, Volume III: Laboratory Analytical Methodology and Equipment Criteria. (Aeronautical). (Navy) NAVAIR 17-15-50.3, (Army) TM 38-301-3, (Air Force) TO 33-1-37-3, and (Coast Guard) CGTO 33-1-37-3, July 31, 2012. This document presents the methodology for evaluating spectrometric analyses of samples from aeronautical equipment. The methodology enables an evaluator to identify wear metals present in the sample and their probable sources, judge equipment condition, and make recommendations that influence maintenance and operational decisions. Following these recommendations can enhance safety and equipment reliability and contribute to more effective and economic maintenance practices.	
97.	Fuel Tanks Inspections and Related Structures	Verify the AIP includes procedures for inspecting the fuel tanks (and related structures) as per NAVAIR guidance. Bladder-type fuel tank safety is not necessarily ensured by only “on condition” inspections and may require more extensive processes, including replacements. In any event, adequate data must be provided for any justification to inspect rather than replacing the fuel tanks at the end of their life limit.	
98.	Fuel Control Unit (FCU)	Verify the AIP emphasizes the FCU. There have been incidents where the FCU was stuck in idle.	
99.	Broken Systems (Fuel, Oil, and Hydraulic) Lines	Verify the AIP includes procedures for inspecting and replacing fuel, oil, and hydraulic lines according to the applicable NAVAIR requirements; for example, MIL-DTL-8794 and MIL-DTL-8795 specifications.	
100.	Hydraulic Failures	Verify the AIP includes the comprehensive inspection and maintenance of the hydraulic system.	
101.	Aileron Boost	Verify the AIP includes the comprehensive inspection and maintenance of the aileron boost system.	
102.	Systems Functionality and Leak Checks	Verify procedures are in place to check all major T-2 systems in the aircraft for serviceability and functionality. Verify the leak checks of all systems are properly accounted for in the AIP per the NAVAIR requirements.	
103.	Oil, Fuel, and Hydraulic Fluids	Verify procedures are in place to identify and use a list of equivalents of materials for replacing oil, fuel, and hydraulic fluids. A good practice by many operators is to include a cross-reference chart for NAVAIR and U.S. lubricants as part of the AIP.	
104.	Electrical System and Batteries	Verify functionality of the generator and the compatibility of the aircraft’s electrical system with any new battery installation or other system and component installation or modification. Avoiding overload conditions is essential because this is a known problem with the aircraft’s electrical system.	
105.	Borescope Engine	Recommend the AIP incorporate borescope inspections of the engine at 50 hours per the applicable inspection procedures. AC 43.13-1 can be used as a reference.	
106.	JT-12 and CJ610 Airworthiness Directives (AD)	Recommend the applicable ADs involving certificated versions of the J60 and J85, namely the JT-12 and the CJ610, be considered as part of the AIP. These are known safety issues that must be addressed. This adds a level of safety to the operation of the aircraft.	
107.	Pitot/Static, Lighting, and Avionics and Instruments	Verify compliance with all applicable 14 CFR requirements (that is, § 91.411) concerning the pitot/static system, exterior lighting (that is, adequate position and anti-collision lighting), transponder, avionics, and related instruments.	
108.	Oxygen System (Gaseous System)	Emphasize the inspection of the oxygen system (bottles and regulator) at the required calendar time. Address any modifications. Compliance with § 91.211, Supplemental Oxygen, is required. Recommend adherence to § 23.1441, *Oxygen Equipment and Supply*. Moreover, per FAA Order 8900.1, change 124, chapter 57, *Maintenance Requirements for High-Pressure Cylinders Installed in U.S. Registered Aircraft Certificated in Any Category*, each high-pressure cylinder installed in a U.S.-registered aircraft must be a cylinder manufactured and approved under the requirements of 49 CFR, or under a special permit issued by Pipeline and Hazardous Materials Safety Administration (PHMSA) under 49 CFR part 107. There is no provision for the FAA to authorize “on condition” for testing, maintenance, or inspection of high-pressure under 49 CFR. The issue is when the bottles are removed from the aircraft. It is industry knowledge that non-U.S. bottles may be installed as long as they are within their hydrostatic test dates. A problem arises when removing the bottles for hydrostatic testing. Maintenance programs require these bottles to be hydrostatic tested. Once the bottles are removed from the aircraft, they are not supposed to be hydrostatic tested, recharged, or reinstalled in any aircraft. Moreover, these bottles cannot be serviced (on board) after the testing date has expired.	

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109.	Oxygen System (LOX)	The T-2 requires a functional, well-maintained oxygen system for high-performance/high-altitude flight. A NAVAIR reference to the proper oxygen is MIL-O-21749. The 5-liter oxygen system is a high caution item and must be better addressed, including how to troubleshoot around oxygen without starting a fire or causing personal injury. For example, some areas around the aircraft are hazardous to personnel when the oxygen converter overflows during filling. The equipment needs to be checked. Most T-2s were equipped with a liquid oxygen (LOX) system, which was a complex and dangerous system. In addition to the obvious issues in handling LOX, the system had components such as a LOX converter and an SEQ. The TMU-27/M 50-gallon LOX tank was a typical cart used to refill aircraft LOX systems. While LOX can be serviced at much lower pressures than those required for gaseous oxygen systems, it does require special equipment and handling. It reacts violently with many substances, including some found around aircraft. Thus, for safety reasons, normally only one maintenance person at a time handles the LOX refilling operation. NAVAIR has guidance for this and it should be followed, along with the equipment's own maintenance instructions manual (MIM) and/or NAVAIR 13-1-6.4, Oxygen Equipment Manual. In addition, all related equipment must be checked. The system installed should have a record of who serviced and inspected it, that is, AvOX in November 1991. In any case, T-2 operators may have replaced the LOX system with a pressure system (refer to above). Refer to TECHNICAL MANUAL-Daily/Servicing Preservation/ASPA Maintenance Requirements Model T-2, NAVAIR 01-60GAB-6-3.	
110.	14 CFR § 23.1441	Recommend any pressure oxygen system meets the intent and scope of § 23.1441 to ensure an adequate level of safety. T-2 operators may have installed oxygen systems in compliance with § 23.1441, which states in part: "that (a) If certification with supplemental oxygen equipment is requested, or the airplane is approved for operations at or above altitudes where oxygen is required to be used by the operating rules, oxygen equipment must be provided that meets the requirements of this section and §§ 23.1443 through 23.1449. Portable oxygen equipment may be used to meet the requirements of this part if the portable equipment is shown to comply with the applicable requirements, is identified in the airplane type design, and its stowage provisions are found to be in compliance with the requirements of § 23.561, (b) the oxygen system must be free from hazards in itself, in its method of operation, and its effect upon other components, (c), there must be a means to allow the crew to readily determine, during the flight, the quantity of oxygen available in each source of supply, (d) each required flight crewmember must be provided with—(1) Demand oxygen equipment if the airplane is to be certificated for operation above 25,000 ft, (2) Pressure demand oxygen equipment if the airplane is to be certificated for operation above 40,000 ft, and (e) there must be a means, readily available to the crew in flight, to turn on and to shut off the oxygen supply at the high pressure source. This shutoff requirement does not apply to chemical oxygen generators."	
111.	Anti-G Suit System	If installed, verify the anti-G suit system's serviceability.	
112.	Cockpit Instrumentation Markings	Verify all cockpit markings are legible and use proper English terminology and in units acceptable to the FAA.	
113.	T-2 Safety Markings and Stenciling	Verify appropriate safety markings required by the NAVAIR T-2 technical manuals (that is, stenciling and "Remove Before Flight" banners) have been applied and are in English. These markings provide appropriate warnings/instruction regarding areas of the aircraft that could be dangerous. These areas include intakes, exhaust, air brakes, and ejection seats. In the case of ejections seat systems, and as noted in FAA Order 8130.2, paragraph 4074(e), "a special airworthiness certificate will not be issued before meeting this requirement."	
114.	Incorrect Hardware	Verify the AIP incorporates the use of the correct hardware, for example, bolts. This must be emphasized in all civil operations because (1) original hardware may be difficult to acquire and (2) some aircraft may incorporate the non-approved items today.	
115.	Cockpit FOD	Verify the AIP addresses thorough inspection and cleaning of the cockpit area to preclude inadvertent ejection, flight control interference, pressurization valves clogging, and other problems. This is a standard NAVAIR/U.S. Navy practice.	
116.	Tires and Wheels	Verify use of proper tires and/or equivalent substitutes (including inner tubes) and adherence to any tire limitation, such as allowed number of landings, inflation requirements, and the use of retreaded tires. The type of tire may dictate the number of landings. Wheels must be properly and regularly inspected and balanced.	
117.	Explosives and Propellants	Check compliance with applicable Federal, State, and local requirements for explosives and propellants in terms of use, storage, and disposal, in addition to verifying NAVAIR requirements are followed. One former military aircraft operator notes it obtained pyrotechnic clearance through the ATF. This is not simply an issue concerning one type of explosives but several depending on the different pyrotechnics used in the ejection system itself. For example, concerning the ejection seat, NAVAIR states "the rocket catapult must be inspected whenever it is removed from the shipping container for use and before returning it to stowage. If the rocket catapult is found in a hazardous condition, explosive ordinance disposal (EOD) personnel must be immediately notified. After the rocket catapult is rendered safe, or if it is rejected for any other reason, it must be disposed of in accordance with NAVAIR 11-85-1."	
118.	T-2 In-Flight Canopy Separation	Ensure the AIP addresses the proper maintenance and operating condition of all canopy locks.	

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119.	Canopy Seals	Test canopy seals for leaks (that is, use ground test connection).	
120.	Emergency Canopy Jettison Mechanism	Verify the AIP includes testing the T-2 emergency canopy jettison mechanism. It must be functional and properly inspected per the applicable technical guidance.	
121.	Brake System	Emphasize a detailed inspection of the brake assemblies, adhere to NAVAIR's inspection guidelines and replacement times, and consider more conservative inspections. Recommend brake inspection at 20 to 30 landings.	
122.	External Fuel Tanks	Verify the type, condition, installation, and removal of any external tanks meet NAVAIR requirements. Only external tanks cleared for use by NAVAIR may be used on the aircraft. The only modification allowed to the external tanks is to prevent jettisoning. Accidental jettisoning of the tanks is a safety hazard. Any means of releasing the tanks during aircraft operation must be disabled.	
123.	Arresting Hook (Tail Hook) Maintenance	Require proper maintenance of the arresting hook and related safety precautions on the ground per NAVAIR guidance. If the hook is not maintained to specifications, it should be made inoperable. In addition, the arresting hook is a significant safety risk that must be addressed in ground operations and properly secured after flight (with the arresting hook strap), especially during exhibition of the aircraft where untrained personnel and the public could be injured. The following account from an air show illustrates this concern: "I was standing at ease in front of my [aircraft]. The sun was hot, and the heat waves were coming up from the ramp. Next to me was an easel with a large poster containing all the statistics about my [aircraft]. No one ever read it as far as I could tell. They would walk up to me, look at the airplane, and then start asking me questions. One kid asked me what I thought was a strange question, until I looked back over my shoulder where he was looking. His question was, 'will that tail hook come down if the safety pin is in it?' As I started to answer him, I turned around to see another kid swinging on the tail hook. It wasn't supposed to come down, but with a three-thousand pound pressure charge on it, I didn't want to let him test it. It would have driven him right into the ramp if it had actuated. I politely got the kid away from the hook and became somewhat more vigilant for the rest of the day." Cook, Jerry W. *Once a Fighter Pilot,* 1996. Based on this account, the hook presents a great safety issue while on the ground and must be secured after flight.	
124.	Hoses and Cables	Inspect and replace hoses and cables appropriately. Due to the age of all T-2 aircraft, and in many cases, inadequate storage history, it is essential to ensure thorough inspections of all hoses and cables (multiple systems) and replace them in accordance with NAVAIR guidance and requirements.	
125.	Grounding	Verify adequate procedures are in place for grounding the aircraft. Static electricity could cause a fire or explosion, set off pyrotechnic cartridges, or result in any combination of the above. In grounding the aircraft, it is essential that all electrical tools are grounded, and industry-approved explosion-proof flashlights or other lighting sources be used.	
126.	TO 00-25-172	Use TO 00-25-172, Ground Servicing of Aircraft and Static Grounding/Bonding (August 2012) as the baseline for all servicing functions. This manual describes physical and/or chemical processes that may cause injury or death to personnel, or damage to equipment, if not properly followed. This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment.	
127.	Antennae	Verify any original antennas are compatible with all installed electronics. In addition, verify the AIP includes the appropriate inspections of the antennae. Some new avionics may impose airspeed limitations. Over the years, many different antennae were installed in the T-2. For the basics on this issue, refer to Higdon, David. Aircraft as Antenna Farm. *Avionics,* Vol. 49, No. 9 (September 2012).	
128.	Transparencies Problems	Ensure proper transparencies maintenance for safe operations. Recommend monitoring/inspecting canopy for crazing every 10 hours of flight.	
129.	Hard Landings and Over G Situations	Verify hard landing and over-G inspection programs are adopted. This is especially important when acrobatics are performed or when the aircraft is involved in military support missions outside the scope of its experimental certificate (that is, public aircraft operations).	
130.	Parts Fabrication	Verify engineering (that is, Designated Engineering Representative (DER)) data supports any part fabrication by maintenance personnel. Unfortunately, many modifications are made without adequate technical and validation data. AC 43.18, Fabrication of Aircraft Parts by Maintenance Personnel, may be used for guidance.	
131.	Wing and Tail Bolts and Bushings	Ask about inspections and magnafluxing of wings, and tail bolts and bushings. Recommend the AIP incorporate other commonly used and industry-accepted practices involving non-destructive inspection if not addressed in the manufacturer's maintenance and inspection procedures.	
132.	Landing Gear Retraction Test	Verify the AIP provides for the regular landing gear retraction test as per NAVAIR procedures and required equipment.	

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133.	Landing Gear Doors	Verify the AIP incorporates adequate inspection procedures for the landing gear doors, actuators, and sequencers.	
134.	Flight Control Balancing and Deflection	Verify flight controls were balanced per the NAVAIR maintenance manual(s) after material replacement, repairs, and painting. Verify proper rigging and deflection. In several former military aircraft, damage to flight controls has been noticed when inadequate repairs have been performed. If there are no adequate records of the balancing of the flight controls, the airworthiness certificate should not be issued.	
135.	Speed Brake	Verify proper condition, deflection, and warning signage of the speed brakes. The AIP and SOPs should also address the dangers the air brake poses to ground personnel.	
136.	Accurate Weight & Balance (W&B)	Review original W&B paperwork. Adherence to NAVAIR/OPNAV guidance is critical in an aircraft like the T-2. If needed, FAA-H-8083-1, Aircraft Weight and Balance Handbook, can also be used if documentation by the applicant appears to be inadequate. Several former military aircraft accidents have been linked to center of gravity miscalculations. Note: In the T-2, removal of military equipment may have an impact on the aircraft's W&B, especially in those cases where the equipment in question may not be properly documented in the W&B data. The appropriate NAVAIR *Aircraft Weight and Balance Records* should be reviewed. Refer to *T-2 OPNAV Aircraft Records* above. Ensure adequate W&B procedures, including scale calibration. It is recommended that the W&B paperwork that came with the aircraft be checked. There are many cases where W&B data is not only missing, but dangerously inadequate. Moreover, the fact is that many pieces of equipment installed in the aircraft when the aircraft was in military service is either removed or replaced and thus an accurate W&B is necessary. W&B records must also show the aircraft is weighed under each of the following conditions: (1) when changes, modifications, or repairs are accomplished and calculated or actual weight and moment data for these changes are not available, (2) when recorded weight and balance data are suspected of being in error, (3) when unsatisfactory flight characteristics are reported by the pilot, and these characteristics cannot be traced to flight control system malfunction, improper aircraft loading, or errors in weight and balance data and computations, (4) when weight and balance handbooks have been lost or damaged (A new record must be promptly prepared), (5) when an aircraft has been painted and (6) when an aircraft has not been weighed in five years. Related records include— *(a)* Record of Weight and Balance, DD Form 365F; *(b)* Basic Weight Checklist, DD Form 365-1; *(c)* Airplane Weight Record, DD Form 365-2; *(d)* Basic Weight and Balance Record, DD Form 365-3; *(e)* Load data, charts, graphs, and weighing procedures for an aircraft; and *(f)* Weight and Balance Clearance, DD Form 365-4.	
137.	"Experimental" Markings	Verify the word "EXPERIMENTAL" is located immediately next to the canopy railing, on both sides, as required by § 45.23(b). No subdued markings.	
138.	N-Number	Verify the marking required by §§ 45.25 and 45.29(b) concerning the registration number (N-number), its location, and its size are complied with. If non-standard markings are proposed, verify compliance with Exemption 5019, as amended, under regulatory Docket No. 25731.	
139.	Type of Ejection Seat System	Identify the type of ejection seat fitted to the aircraft. Generally, the T-2 is equipped with the LS-1 ejection seat. The type of seat changes many aspects of operations and maintenance.	
140.	Ejection Seat OEM Support	Ask the applicant whether the ejection seat OEM (1) still supports the T-2 ejection seats, and (2) whether the OEM supplies components and parts. It is critical to clearly understand if and how the OEM supports both the earlier or upgraded ejections seat. Note: The NAVAIR supply chain may not be available for civilian use.	
141.	Ejection Seat System Maintenance	Ensure maintenance and inspection of the ejection seat and other survival equipment is performed in accordance with the NAVAIR applicable technical guidance by trained personnel. Include specific inspections and recordkeeping for pyrotechnic devices. Ejection seat system replacement times must be adhered to. No "on condition" maintenance may be permitted for rocket motors and propellants. Make the distinction between replacement times, that is, "shelf life" vs. "installed life limit." For example, a 9-year replacement requirement is not analogous to a 2-year installed limit. If such maintenance documentations and requirements are not available, the seat must be deactivated.	
142.	Ejection Seat Components Life-Limit	Ensure life-limit requirements concerning the ejection seat are followed. No deviations or extensions should be permitted. If the seat is not properly maintained, including current pyrotechnics, it must be disabled.	

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143.	Ejection Seat System Maintainers Training	Require adequate ejection seat training for maintenance crews. On May 9, 2012, an improperly trained mechanic accidentally jettisoned the canopy of a former military aircraft while performing maintenance and was seriously injured.	
144.	Ejection Seat Modifications	Ask whether the LS-1 seat installed conforms with AFC 172. This modification improved safe escape capability. Prohibit ejection seat modifications unless directly made by the manufacturer or permitted under NAVAIR technical guidance.	
145.	Ground Support Equipment Maintenance	Verify the AIP provides for the proper maintenance of all required NAVAIR-approved ground support equipment.	
146.	Inspect and Repair as Necessary (IRAN)	Verify IRAN is detailed and uses adequate technical data (that is, include references to acceptable technical data) and adequate sequence for its completion if it is proposed. There is no data showing T-2s were maintained under an IRAN-type program. There is evidence that some "IRANs" do not equate to an acceptable standard in terms of tasks and documentation. An IRAN must have a basis and acceptable standards. It is not analogous to an "on condition" inspection. It must have an established level of reliability and life extension. An IRAN is not a homemade inspection program. At the IRAN level of maintenance, every component is inspected and repaired to return it to a condition of safe operation, not just its appearance. It is noted an IRAN does not begin with a general inspection (as to determine what gets removed or not), but rather starts with the disassembly and assessing the parts and components for wear and deterioration to bring it back too new/original limits as per the appropriate guidance. Note: USAF studies indicate IRANs are valuable because they indicate "inspection and repair of defects discovered in deport IRAN could be accomplished at base level" and thus do address many of the issues and defects the aircraft develops over time.	

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T-2 Operating Limitations and Operational Issues			
147.	AIP and Related Documentation	Require adherence to the AIP and related documentation as part of the operating limitations.	
148.	Understanding of the Operating Limitations	Require the applicant to sign the Acknowledgment of Special Operating Limitations form.	
149.	NATOPS	It is important that all aspects of the operation of the aircraft being certificated be accomplished in adherence with the Naval Air Training and Operating Procedures Standardization Program (NATOPS) manual specific to the T-2 version and variant in question, unless limited otherwise by the FAA issued operating limitations. Standardization, based on professional knowledge and experience, provides the basis for development of an efficient and sound operational procedure. The T-2 NATOPS manual standardizes ground and flight procedures but does not include tactical doctrine. Compliance with the stipulated manual procedure is mandatory except as authorized herein. This manual was prepared and kept current by NAVAIR to achieve maximum readiness and safety in the most efficient and economical manner. Checklists and other pertinent extracts from this publication necessary to normal operations and training should be made.	
150.	T-2 Pilot in Command (PIC) Requirements	Refer to the appropriate plot training and checking requirements in FAA Order 8900.1, volume 5, chapter 9, section 2. As a matter of policy, the FAA requires a pilot have a total of 1,000 hours before they can be issued an authorization to act as PIC of an experimental jet unless they were trained by the U.S. military as a jet pilot. The T-2 is a multi-engine aircraft, and the appropriate rating is required. Also recommend a minimum of 10 hours of dual training in preparation for pilot authorization flight check.	
151.	T-2 Recent Flight Experience	Recommend proficiency and currency of 3 hours per month and five to six takeoffs and landings. The typical general experience of "at least three takeoffs and three landings within the preceding 90 days" may not be sufficient for the safe operation of the T-2. Note: Some flexibility could be provided in addressing this issue such as combining hours and landings (that is, 1 hour and 3 landings) and interjecting, but not replacing, all T-2 flights (within the specified period) with certain high-performance flight profiles in another high-performance military jet.	
152.	T-2 PIC Annual Training	Recommend the T-2 PIC take an annual recurrent training/ride in the aircraft.	
153.	NATOPS PIC Evaluation	Recommend the NATOPS evaluation procedures and criteria for the T-2 be used as part of flight training and checkout procedures.	
154.	Flight Manuals	Ensure the PIC operates the aircraft as specified in the most current version of the flight manual (NAVAIR manual, -1) for the T-2 version being flown.	
155.	Adequate Annual Program Letter	Verify the applicant's annual program letter contains sufficient detail and is consistent with applicable regulations and policies. (Many applicants/operators submit inadequate and vague program letters and fail to submit them on an annual basis.) Also verify the proposed activities (for example, an air show at a particular airport) are consistent with the applicable operating limitations (for example, avoiding populated areas) and do not pose a safety hazard, such as the runway being too short. There may be a need to review the proposed airports to be used.	
156.	T-2 Flight Manual Warnings, Cautions and Notes	Consider requiring review (before flight) of all NAVAIR T-2 flight manual warnings, cautions, and notes. Such a review will greatly enhance safety, especially in those cases where the PIC does not maintain a high level of proficiency in the aircraft. The following definitions apply to warnings, cautions, and notes found throughout this instruction. Warning: Explanatory information about an operating procedure practice, or condition, which may result in injury or death if not carefully observed or followed. Caution: Explanatory information about an operating procedure, practice, or condition, which may result in damage to equipment if not carefully observed or followed. Note: Explanatory information about an operating procedure, practice, or condition, which must be emphasized.	
157.	Maintenance and Line Support	Verify the aircraft is operated with qualified crew chief/plane captains, especially during preflight and post-flight inspections as well as assisting the PIC during startup and shutdown procedures. Note: A crew chief (NAVAIR) or plane captain (U.S. Navy) is the person (noncommissioned officer) in charge of the day-to-day operations, maintenance, and ground handling of an aircraft.	

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158.	Ejection Seat System PIC Training	Require adequate ejection seat training for the PIC and crew, if applicable, for the type of seat installed. Note: The record shows the safety record of attempted ejections in civilian former military aircraft is very poor, typically indicating inadequate training leading to ejections outside of the envelope. The ejection envelope is a set of defined physical parameters within which an ejection may be successfully executed. It is primarily an interaction of two independent sets of parameters: the physically designed characteristics of the particular ejection system and the dynamics of the aircraft flight profile at the moment of ejection.	
159.	Ejection Seat System Ground Safety	Verify the safety of ejection seats on the ground. Verify ejection seats cannot be accidentally fired, including prohibiting untrained personnel from sitting on the seats. As DOD states, "the public shall be denied access to the interior of all aircraft employing ejection seats or other installed pyrotechnic devices that could cause injury." In addition, operators should provide security during the exhibition of the aircraft to prevent inadvertent activation of the ejection system from inside or outside the aircraft by spectators or onlookers. The PIC on a recent Jet Warbird operation noted: "Recently we had a case where a guest in the back jettisoned the rear canopy on the ground at the parking position while trying to lock the canopy with the lever on the R/H side… The canopy went straight up for 6 m (20 ft) and fell back on the ground, right in front of the left wing leading edge next to the rear cockpit (fortunately not straight back on the cockpit to punish the guy)." Note: Any ejection seat training must include survival and post-bailout procedures based on the U.S. Navy training appropriate for the equipment being used. Note: As a result of accidents, the public is not allowed to sit on armed ejection seats as DOD policy.	
160.	Ejection Seat System Safety Pins	Require the PIC to carry the aircraft's escape systems safety pins on all flights and high-speed taxi tests. As a recommendation stemming from a fatal accident, the U.K. CAA may require "operators of civil registered aircraft fitted with live ejection seats to carry the aircraft's escape systems safety pins (a) on all flights and high speed taxi tests (b) in a position where they are likely to be found and identified without assistance from the aircraft's flight or ground crews."	
161.	Parachutes	Comply with § 91.307, Parachutes and Parachuting. This regulation includes parachute requirements (1) that the parachute be of an approved type and packed by a certificated and appropriately rated parachute rigger, and (2) if of a military type, that the parachute be identified by an NAF, AAF, or AN drawing number, an AAF order number, or any other military designation or specification number. The parachute must also be rated for the particular ejection seat being used.	
162.	Engine Operating Limits	Adhere to all engine limitations in the applicable NAVAIR NATOPS flight manuals.	
163.	Spool Down Time	Verify the AIP incorporates action(s) following a change in the spool down time of the J60/J85 engine after shutdown. This is critical, as it could indicate an upcoming problem with the engine.	
164.	External Stores	Prohibit the installation of external stores to the wing that were not approved by the manufacturer or the military operator and limit those to external fuel tanks. No external stores may have an in-flight release mechanism. In FAA Order 8130.2, only aircraft certificated for the purpose of R&D may be eligible to operate with functional jettisonable external fuel tanks or stores, but the safety of people and property on the ground still has to be addressed.	
165.	Asymmetric Wing Mounted Stores	Prohibit asymmetric wing-mounted equipment regardless of the applicable -1 manual.	
166.	Emergency Stores Release Handle (ESRH)	Disable the ESRH.	
167.	Master Armament Switch	Disable and disconnect the Master Armament Switch from any system. Weapon-related buttons (bomb/rocket button, trigger) on the control stick grip must also be disabled and disconnected from all systems.	
168.	Restrict Acrobatics	Restrict acrobatics per the appropriate flight manual.	
169.	Mach Meter and Airspeed Calibration	Require the installation and calibration of a Mach meter or verify the PIC makes the proper Mach determination before flight. Unless the airspeed indicator(s) is properly calibrated, transonic range operations may have to be restricted.	
170.	Accelerometer	Ensure the aircraft's accelerometer is functional. This instrument is critical to remain within the required G limitation of the aircraft.	
171.	Angle of Attack (AOA Indicator	Ensure the aircraft's AOA indicator is functional.	

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172.	High-Speed Controllability	Recommend limiting transonic operations by 10 percent below MMO. This provides a good safety margin and could be addressed in the operating limitations, the AFM, and related standard operating procedures (SOP).	
173.	Phase I Flight Testing	Recommend, at a minimum, all flight tests and flight test protocol(s) follow the intent and scope of acceptable NAVAIR/U.S. Navy functionality test procedures. The aircraft needs detailed Phase I flight testing for a minimum of 10 hours. Returning a high-performance aircraft such as the T-2 to flight status after restoration cannot be accomplished by a few hours of "flying around." Safe operations also require a demonstrated level of reliability.	
174.	Post-Maintenance Check Flights	Recommend incorporating post-maintenance flight checks in the maintenance and operation of the aircraft, and use of TO 1-1-300, Maintenance Operational Checks and Flight Checks, June 15, 2012, as a reference.	
175.	Flight Over Populated Areas	Prohibit flights over populated areas, including takeoffs and landings, if the ejection seat is functional. If not, the aircraft may be operated over populated areas for the purpose of takeoff and landing only, and only in Phase II operations. The area on the surface described by the term "only for the purpose of takeoff and landing" is the traffic pattern. For the purpose of this limitation, the term "only for the purpose of takeoff and landing" does not allow multiple traffic patterns for operations such as training or maintenance checks. As the NTSB stated in 2012 following the fatal accident of a high-performance experimental aircraft, "the fine line between observing risk and being impacted by the consequences when something goes wrong was crossed." In many cases, and although "the pilots understood the risks they assumed; the spectators assumed their safety had been assessed and addressed," and it was not.	
176.	G Limitations	Consider G limits. A limit of 5 Gs and -1G could be considered. There is no justification to take the aircraft anywhere near its original limitations. The fact that the aircraft could be loaded to 6 Gs does not mean such performance should be attempted or is inherently safe. This is especially true given the aircraft's age and historical use.	
177.	Visual Meteorological Condition (VMC) and Instrument Flight Rules (IFR) Operations	Recommend only day VMC operations. If IFR operations are permitted, prohibit operations in known icing conditions—aircraft is not properly equipped for icing conditions. Comply with § 91.205.	
178.	Carrying of Passengers §91.319(a)(2)	Prohibit the carrying of passengers (and property) for compensation or hire at all times. For-hire flight training is permitted only in accordance with an FAA-issued letter of deviation authority (LODA). FAA LODA policy limits training to pilots eligible for T-2 experimental aircraft authorization.	
179.	Passenger Training and Limitations	Implement adequate training requirements and testing procedures if a person is carried on the rear seat [refer to above for limitations under §91.319(a) (2)] to allow the performance of that crew's position responsibilities per the applicable Crew Duties section of the NAVAIR Flight Manual. This training should not be a simple checkout, but rather a structured training program (for example, ground school on aircraft systems, emergency and abnormal procedures, "off-limits" equipment and switches, and actual cockpit training). The back seat qualification should also include (1) ground egress training (FAA approved ejection seat training), (2) ejection seat and survival equipment training, (3) abnormal/emergency procedures, and (4) normal procedures. In addition to any aircraft specific (that is, systems and related documentation) training, we recommend using the Naval Aviation Survival Training Program **(**Non-aircrew NASTP Training) and/or the United States Air Force Aerospace Physiology Program (AFI 1 I-403, Aerospace Physiological Training Program) to develop these programs. In addition, passenger physiological and high-altitude training should be implemented for all operations above 18,000 ft. This issue can be addressed as part of the operating limitations by requiring the back seat training and incorporating the adequate reference (name) of the operator's training program.	
180.	Spins	Prohibit spins in accordance with section 4 of the T-2 NATOPS Flight Manual.	
181.	Reduce Vertical Separation Minimums (RVSM)	Prohibit operations above RVSM altitudes (FL290).	
182.	High-Altitude Training	Recommend the PIC complete an FAA-approved physiological training course (for example, altitude chamber). Refer to FAA Civil Aerospace Medical Institute (CAMI) Physiology and Survival Training website for additional information.	
183.	Minimum Equipment for Flight	Ask the applicant to specify minimum equipment for flight and develop such a list consistent with the applicable NAVAIR requirements and § 91.213.	
184.	Post-flight and Last Chance Check Procedures	Recommend establishing post-flight and last chance inspection per NAVAIR guidance. Note: Last chance checks may include coordination with the airport and ATC for activity in the movement areas.	

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185.	Minimum Runway Length	Recommend a minimum runway length. In addition, ensure the PIC verifies, using the appropriate NATOPS aircraft performance charts (Performance Supplement), sufficient runway length is available considering field elevation and atmospheric conditions. To add a margin of safety, use the following: <u>For Takeoff</u> • No person may initiate an airplane takeoff unless it is possible to stop the airplane safely on the runway, as shown by the accelerate-stop distance data, and clear all obstacles by at least 50 ft vertically (as shown by the takeoff path data) or 200 ft horizontally within the airport boundaries and 300 ft horizontally beyond the boundaries, without banking before reaching a height of 50 ft (as shown by the takeoff path data) and after that without banking more than 15 degrees. • In applying this section, corrections must be made for any runway gradient. To allow for wind effect, takeoff data based on still air may be corrected by taking into account not more than 50 percent of any reported headwind component and not less than 150 percent of any reported tailwind component. <u>For Landing</u> • No person may initiate an airplane takeoff unless the airplane weight on arrival, allowing for normal consumption of fuel and oil in flight (in accordance with the landing distance in the AFM for the elevation of the destination airport and the wind conditions expected there at the time of landing), would allow a full stop landing at the intended destination airport within 60 percent of the effective length of each runway described below from a point 50 ft above the intersection of the obstruction clearance plane and the runway. For the purpose of determining the allowable landing weight at the destination airport, the following is assumed: o The airplane is landed on the most favorable runway and in the most favorable direction, in still air. o The airplane is landed on the most suitable runway considering the probable wind velocity and direction and the ground handling characteristics of that airplane, and considering other conditions such as landing aids and terrain.	
186.	Runway Considerations	Consider accelerate/stop distances, balanced field length, and critical field length in determining acceptable runway use per Classic Jet Aircraft Association (CJAA) guidance. To enhance T-2 operations, it is recommended takeoff procedures that include a minimum acceleration check speed (using a ground reference during the takeoff run to check for a pre-calculated speed).	
187.	Jet Exhaust Dangers	Establish adequate jet blast safety procedures per NAVAIR 01-60GAB-1.	
188.	Servicing and Flight Servicing Certificate	Ensure the applicant verifies ground personnel are trained for T-2 operations with an emphasis on the potential for fires during servicing. Prohibit non-trained personnel from servicing the aircraft. Recommend a Flight Servicing Certificate or similar document be used by the ground personnel to attest to the aircraft's condition (that is, critical components such as tires) before each flight to include the status of all servicing (that is, liquid levels, fuel levels, hydraulic fluid, and oxygen). Specific servicing areas in the T-2 include: oxygen tanks and filler, fuel fillers (4), engine oil tank, brake control unit, batteries, external power receptacle, rain removal system, single-point refueling (needs to be disabled), emergency air bottle and filler, and hydraulic reservoir.	
189.	Ground Support Equipment	Verify all required ground equipment is available and in a serviceable condition.	
190.	Aerial Target Towing	Restrict all towing. Notwithstanding the standard language in the FAA Order 8130.2 limitations concerning towing, the T-2 is not to be used for towing targets because such operations pose a danger to property and people on the ground and endanger the aircraft.	
191.	Hot and Pressure Refueling	Prohibit hot and pressure refueling. There are too many dangers with these types of operations.	
192.	Personal Flight Equipment	Recommend the operator use the adequate personal flight equipment and attire to verify safe operations. This includes a helmet, oxygen mask, fire retardant (Nomex) flight suit, gloves (that is, Nomex or leather), adequate foot gear (that is, boots), and clothing that does not interfere with cockpit systems and flight controls. Operating with a live ejection seat requires a harness. Therefore, recommend only an approved harness compatible with the ejection seat be used.	

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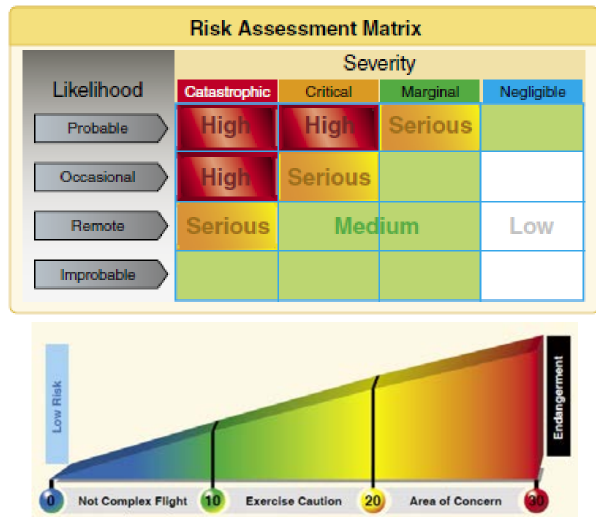
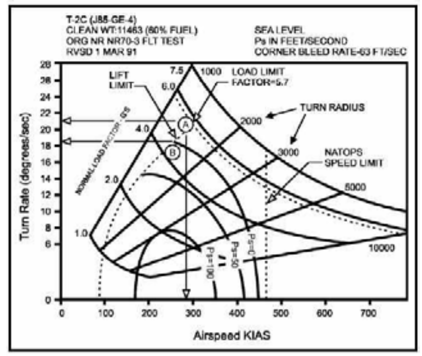
193.	Aircraft Rescue and Fire Fighting (ARFF) Coordination	Coordinate with ARFF personnel at any airport of landing. A safety briefing should be provided that includes— • Ejection seat system overview (making ejection seat safe, including location and use of safety pins); • Canopy jettison; • Fuel system and fuel tanks; • Intake dangers, engine shut-of- throttle, fuel, and batteries; • Flooding the engine; • Fire access panels and hot exhaust ports; and • Crew extraction-harness, oxygen, communications, PEC, and forcible entry. ARFF personnel should be provided with the relevant sections of the aircraft -1 (AFM) and other appropriate references such as Fire Fighting and Aircraft Crash Rescue, Vol. 3, Air University, Maxwell AFB, 1958. There is additional documentation to address the issues associated with the potential crash of an aircraft like the T-2. An additional reference is NATOPS U.S. NAVY Aircraft Firefighting and Rescue Manual, NAVAIR 00-80R-14, 15 OCTOBER 2003. The FAA maintains a series of Advisory Circulars that provide guidance for Crash Fire Rescue personnel. Refer to AC 5210-17 Programs for Training of Aircraft Rescue and Firefighting. Note: On November 1, 2012, the NTSB issued Safety Recommendation A-12-64 through -67. The NTSB recommends the FAA require the identification of the presence and type of safety devices (such as ejection seats) that contain explosive components on the aircraft. It further stated this information should be readily available to first responders and accident investigators by displaying it on the FAA's online aircraft registry, and the FAA should issue and distribute a publicly available safety bulletin to all 14 CFR part 139-certificated airports and representative organizations of off-airport first responders, such as the International Association of Fire Chiefs and the National Fire Protection Association, to (1) inform first responders of the risks posed by the potential presence of all safety devices that contain explosive components (including ejection seats) on an aircraft during accident investigation and recovery, and (2) offer instructions about how to quickly obtain information from the FAA's online aircraft registry regarding the presence of these safety devices that contain explosive components on an aircraft.	
194.	ATC Coordination	Coordinate with ATC before any operation that may interfere with normal flow of traffic to ensure the requirement to avoid flight over populated areas is complied with. Note: ATC does not have the authority to waive any of the operating limitations or operating rules.	
195.	Formation Takeoffs and Landings	Prohibit formation takeoffs and landings. There is no civil use, including display, to justify the risks involved.	
196.	Military/Public Aircraft Operations	Require the operator to obtain a declaration of PAO from the contracting entity or risk civil penalty for operating the aircraft outside the limits of the FAA experimental certificate. Some T-2 operators may enter into contracts with the DOD to provide military missions such as air combat maneuvering (ACM), target towing, and electronic counter measures (ECM). Such operations constitute PAO, not civil operations under FAA jurisdiction. Verify the operator understands the differences between PAOs and operations under a civil certificate. For example, the purpose of an airworthiness certificate in the exhibition category is limited to activities listed in § 21.191(d). Note: The following notice, which was issued by AFS-1 in March 2012, needs to be communicated to the applicant: "Any pilot operating a U.S. civil aircraft with an experimental certificate while conducting operations such as air-to-air combat simulations, electronic counter measures, target towing for aerial gunnery, and/or dropping simulated ordinances is operating *contrary* to the limits of the experimental certificate. Any operator offering to use a U.S. civil aircraft with an experimental certificate to conduct operations such as air-to-air combat simulations, electronic counter measures, target towing for aerial gunnery, and/or dropping simulated ordinances pursuant to a contract or other agreement with a foreign government or other foreign entity would not be doing so in accordance with any authority granted by the FAA as the State of Registry or State of the Operator. These activities are not included in the list of experimental certificate approved operations and may be subject to enforcement action by FAA. For those experimental aircraft operating overseas *within* the limitations of their certificate, FAA Order 8130.2, section 7, paragraph 4071(b) states that if an experimental airworthiness certificate is issued to an aircraft located in or outside of the United States for time-limited operations in another country, the experimental airworthiness certificate must be accompanied by appropriate operating limitations that have been coordinated with the responsible CAA *before* issuance." For additional information on public aircraft status, refer to 76 FR 16349, Notice of Policy Regarding Civil Aircraft Operators Providing Contract Support to Government Entities (Public Aircraft Operations), dated March 23, 2011.	
197.	TO 00-80G-1 and Display Safety	Recommend using TO 00-80G-1, Make Safe Procedures for Public Static Display, dated November 30, 2002, in preparing for display of the aircraft. This document addresses public safety around aircraft in the air show/display environment. It covers hydraulics, egress systems, fuel, arresting hooks, electrical, emergency power, pneumatic, air or ground launched missiles, weapons release (including inert rounds), access panels, antennae, and other equipment that can create a hazard peculiar to certain aircraft.	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
T-2 Aircraft Flight Manual (AFM), SOPs, and Best Practices			
198.	Operational Risk Management (ORM)	Recommend an ORM-like approach be implemented by the T-2 owner/operator. The ORM employs a five-step process: (1) Identify hazards, (2) Assess hazards, (3) Make risk decisions, (4) Implement controls, and (5) Supervise. The use of ORM principles will go a long way in enhancing the safe operation of T-2 aircraft. ORM is a systematic decision-making process used to identify and manage hazards that endanger naval resources. ORM is a tool used to make informed decisions by providing the best baseline of knowledge and experience available. Its purpose is to increase safety by anticipating hazards and reducing the potential for loss. The ORM process is used on three levels based upon time and assets available. These include: (1) Time-critical: A quick mental review of the five-step process when time does not allow for any more (that is, in-flight mission/situation changes), (2) Deliberate: Experience and brain storming are used to identify hazards and is best done in groups (that is, aircraft moves, fly on/off), and (3) In-depth: More substantial tools are used to thoroughly study the hazards and their associated risk in complex operations. The ORM process includes the following principles: accept no unnecessary risk, anticipate and manage risk by planning, and make risk decisions at the right level. The following Air Force press release is a good ORM-based analysis of a 2011 T-38 accident: “Investigators found that crash landing at Ellington Field, Texas, resulted from a series of mistakes by a fatigued pilot during landing, and they admonished the pilot's squadron for creating a ‘culture of risk tolerance.’ The pilot became disoriented and misjudged the landing runway, lost altitude too quickly and allowed his airspeed to fall below a safe level, according to the Air Education and Training Command accident investigation report. This resulted in catastrophic damage to the landing gear and right wing. The mishap occurred during the fourth sortie of the day as a night solo continuations-training mission into Ellington Field, near Houston, on a squadron cross-country sortie. The pilot safely departed the aircraft when it came to rest on the ground, and he sustained only minor injuries. In addition to the culture of risk tolerance, the report cited inadequate operational risk management of the cross-country weekend plan. ‘Inappropriate supervisory policy, combined with inadequate ORM, led to the mishap pilot flying a high-risk mission profile,’ the report said. The board further found that the pilot's fatigue, resulting from the aggressive flight plan approved by his squadron, substantially contributed to the mishap. ‘Outside of these cross-country weekends, it was rare for an (instructor pilot) to fly four sorties in one day. There was a mindset that a day consisting of four continuation training sorties was generally less risky than a day consisting of three student pilot instructional sorties,’ the report said. ‘The sortie was (the mishap pilot's) fourth sortie of the day and was flown entirely at night... This mishap was caused by the authorization and execution of a mission having an unnecessarily high level of risk relative to the real benefits.’ Damage to the aircraft -- landing gear, engines, right wing and tail section -- was assessed at $2.1 million. The impact also caused minor damage to the runway, but no damage to private property, the report said. Risk mitigations were put in place to address the issues outlined in the accident investigation report.” See http://www.torch.aetc.af.mil/news/story.asp?id=123277394.	
199.	System Safety MIL-STD-882B	Recommend the use of MIL-STD-882B, System Safety Program Requirements, in the operation of T-2 aircraft. This guidance is also useful in the maintenance and operation of high-performance former military aircraft. It covers program management, risk identification, audits, and other safety-related practices.	
200.	CRM/SRM	Recommend the applicant and operator adopt a CRM-type program for T-2 operations. While CRM focuses on pilots operating in crew environments, many of the concepts apply to single-pilot operations. Many CRM principles have been successfully applied to single-pilot aircraft, and led to the development of Single-Pilot Resource Management (SRM). SRM is defined as the art and science of managing all resources (both on board the aircraft and from outside sources) available to a single pilot (prior and during flight) to ensure the successful outcome of the flight. SRM includes the concepts of ADM, Risk Management (RM), Task Management (TM), Automation Management (AM), Controlled Flight Into Terrain (CFIT) Awareness, and Situational Awareness (SA). SRM training helps the pilot maintain situational awareness by managing the automation and associated aircraft control and navigation tasks. This enables the pilot to accurately assess and manage risk, and make accurate and timely decisions. Integrated CRM/SRM incorporates the use of specifically defined behavioral skills into aviation operations. Standardized training strategies shall be used in such areas as academics, simulators, and flight training. Practicing CRM/SRM principles will serve to prevent mishaps that result from inadequate crew coordination. At first glance crew resource management for the single pilot might seem paradoxical, but it is not. While multi-pilot operations have traditionally been the focus of CRM training, many elements are applicable to the single pilot operation. AOPA Flight Training described single-pilot CRM to be “found in the realm of aeronautical decision making, which is simply a systematic approach that pilots use to consistently find the best course(s) of action in response to a given set of circumstances.” Wilkerson, Dave. September 2008. From a U.S. Navy standpoint, OPNAVINST 1542.7C Crew Resource Management Program, dated October 12, 2001, can be used as guidance. Also refer to CRM For the Single Pilot. *Vector* (May/June 2008). FAA guidance includes: Summers, Michele M.; Ayers, Frank; Connolly, Thomas; and Robertson, Charles. Managing Risk through Scenario Based Training, Single Pilot Resource Management, and Learner Centered Grading, 2007, and Chapter 17, Airplane Flying Handbook. Print. Airplane Flying Handbook FAA-H-8083-3A.	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
201.	Risk Matrix and Risk Assessment Tool	Recommend using a risk matrix to mitigate risk in T-2 operations. A risk matrix can be used for almost any operation by assigning likelihood and severity. In the case presented, the pilot assigned a likelihood of "occasional" and a severity of "catastrophic." As one can see, this falls in the high risk area. The risk assessment tool in Figure 17-5, chapter 17, Airplane Flying Handbook FAA-H-8083-3A, can also be used.  Source: FAA	
202.	AFM Addendums	Consider additions or restrictions to the AFM. Operational restrictions should be also addressed in the AFM.	
203.	In-Flight Canopy Separation	Revise the pilot checklist and rear-seat occupant briefing to emphasize (that is, "warning—caution") the proper closing of the canopy.	
204.	Fuel Mismanagement	Require special emphasis on fuel starvation and fuel management. There have been cases in T-2s where fuel transfer problems were caused by frozen fuel transfer valves at altitude.	
205.	Speed Limitations Due To Avionics and Other Equipment	Verify the speed limit of the aircraft. Some T-2 operators may install certain types of avionics with speed limitations.	
206.	External Tank(s) Failure	Restrict external tanks to only those cleared by the NAVAIR. Adhere to the drop tank limitations related to (1) takeoff and landing performance, (2) G limits, (3) airspeed, and (4) fuel in the tanks. There should not be any means of jettisoning these tanks while on the ground or in flight. There should not be any modifications to the drop tanks.	
207.	Command Ejection	Ensure SOPs address the command ejection issue, that is, who initiates the ejection and under what circumstances, as per NAVAIR guidance, before the flight if the aircraft is a T-2, and the rear seat is occupied. This is important as illustrated by a U.S. Navy 1992 fatal accident where, after a loss of control situation and the instructor's inability to initiate ejection, the student had difficulty in using the ejection control mechanism (inadequate training), delaying the ejection. With the aircraft in an inverted spin, when the student pulled the ejection handle, it was much too late. Both pilots were killed when they ejected straight into the ground, parachutes unopened.	

<table>
<tr><th>Issue #</th><th>Issue(s)</th><th>Recommended Review, Action(s), and Coordination with Applicant</th><th>Notes, Action(s) Taken, and Disposition</th></tr>
<tr><td>208.</td><td>Single-Engine Handling</td><td>Ensure SOPs emphasize single-engine emergencies and handling.</td><td></td></tr>
<tr><td>209.</td><td>T-2 E-M Diagram</td><td>
Recommend that the SOPs, training, and documentation incorporate a detailed understanding of the T-2 E-M diagram. An aircraft's Energy and Maneuverability (E-M) diagram is an excellent way to graphically see the relationship between two dynamics - operational maneuverability and energy management. This is essential in order to remain “inside” the envelope and avoid high-risks maneuvering. This may assist in remaining within the envelope and avoid high-risks maneuvering. The T-2 E-M diagram is provided below:



An E-M diagram combines three essential parameters on one chart: (1) aircraft structural limitations, (2) turn performance data (turn rate data and turn radius curves), (3) specific power data in the form of Ps curves, and (4) from the above E-M diagram, a few crucial data points can be derived:

Point A: This point at the intersection of the aircraft G limit and lift limit equates to the corner airspeed. We can see from the diagram that this airspeed is approximately 280 KIAS. Corner airspeed has been previously defined as the lowest airspeed at which the maximum g is available. The turn rate at point A is the best instantaneous turn rate. From the diagram, we can see this is approximately 21° of turn per second. The trade off for maneuvering the aircraft at Point A is the energy loss. All maneuvering beyond the Ps=0 curve is energy depleting. According to the legend above the E-M diagram, the energy bleed rate is 63 ft/sec at corner airspeed. Additionally, the E-M diagram shows the effect each maneuver will have on the aircraft's turn radius. For example, at Point A (corner airspeed) we can see the turn radius is approximately 1,500 feet.

Point B: Point B is the maximum sustained turn rate. Point B is on the Ps = 0 curve. As a result, we see that a 19 degree per second sustained turn rate can be achieved without losing energy. The Ps = 0 curve becomes significant when operating on the deck where altitude cannot be traded for airspeed.

E-M Diagram Summary: From the above T-2C E-M diagram, we can extract data points to make a thumbnail sketch of the T-2C's maneuvering capabilities:

<table>
<tr><td>Corner airspeed</td><td>280 KIAS</td></tr>
<tr><td>Max G</td><td>6.0* (gross weight dependent)</td></tr>
<tr><td>Max Instantaneous Turn Rate</td><td>21 degrees/ second</td></tr>
<tr><td>Max Sustained Turn Rate</td><td>19 degrees/ second</td></tr>
<tr><td>Min Turn Radius (at corner speed)</td><td>1500 feet</td></tr>
<tr><td>T-2C simulated weapon system</td><td>20 MM Guns</td></tr>
</table>

(* Max "G" may be lowered by squadron SOP for aircraft life extension).
</td><td></td></tr>
</table>

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
210.	Oxygen Check	Recommend SOPs and training require, before every flight, the pilot to perform the "PRICE" check on the oxygen equipment (PRESSURE, REGULATOR, INDICATOR, CONNECTIONS and EMERGENCY) if a pressure oxygen system is installed. The acronym PRICE is a checklist memory-jogger that helps pilots and crewmembers inspect oxygen equipment. Mix and match components with caution. When interchanging oxygen systems components, ensure compatibility of the components: storage containers, regulators, and masks. This is a particularly important issue because all T-2s, due to their age, may require the use of modern equipment, at least for some components.	
211.	Spool Down Time	Ensure SOPs incorporate noting the spool down time of the J60/J85 engines after shutdown. This is critical as it could be an indicator of an upcoming problem with the engine.	
212.	Specific Range	Recommend SOPs address minimum landing fuel. Verify actual aircraft-specific range (nautical air miles traveled per pound of fuel used).	
213.			
214.	Bingo and Minimum Landing Fuel	Recommend establishing SOPs addressing minimum landing fuel for IFR operations as provided in § 91.151, Fuel Requirements for Flight in VFR Conditions, in addition to § 91.167, to add a safety. In addition, a "Bingo" fuel status (a pre -briefed amount of fuel for an aircraft that would allow a safe return to the base of intended landing) should be used in all flights. Note: Bingo fuel and minimum landing fuel are not necessarily the same in that a call for Bingo fuel and an RTB still required managing the minimum landing fuel. Note: Standard SOP in training squadrons (VT) squadrons was to declare "minimum fuel" at 650 lb. Refer to Peters, Bill. Fuel Starvation, *Approach* (June 1981).	
215.	Suspected Flight Control Failure	Recommend establishing SOPs for troubleshooting suspected in-flight control failures, that is, specific checklist procedures, altitude, and clear location.	
216.	FAA AC 91-79	Recommend the use of FAA AC 91-79, Runway Overrun Prevention. According to AC 91-79, safe landings begin long before touchdown. Adhering to SOPs and best practices for stabilized approaches will always be the first line of defense in preventing a runway overrun.	
217.	FAA AC 61-107	Recommend the use of FAA AC No. 61-107 Operations of Aircraft at Altitudes Above 25,000 ft MSL and/or Mach Numbers (MMO) Greater Than 0.75. This AC can be used to assist pilots who are transitioning from aircraft with less performance capability to complex, high-performance aircraft that are capable of operating at high altitudes and high airspeeds (like the T-2). It also provides knowledge about the special physiological and aerodynamic considerations involved in these kinds of operations.	
218.	360º Overhead Pattern Technique	Recommend the operator consider implementing SOPs to refrain from 360-degree overhead patterns. There is no civil application of this technique.	
219.	Reporting Malfunctions and Defects	Ask the applicant/operator to report (to the FSDO or MIDO) incidents, malfunctions, and equipment defects found in maintenance, preflight, flight, and post-flight inspection. This would yield significant safety benefits to operators and the FAA. A 2011 study for the U.S. Navy points to the effectiveness of such practices. It stated: "The data analysis carried out was a comprehensive attempt to examine the strength of the link between safety climate and mishap probability. Our findings would seem to support the premise that safety climate and safety performance are, at best, weakly related. Mishaps are rare events, and they describe only part of the spectrum of risks pertaining to a work system. We suggest that measuring workers' self-reported safety attitudes and behavior is an alternative way to assess the discriminate validity of safety climate." O'Connor, October 2011. In other words, reporting safety issues, such as malfunctions, goes a long way in preventing an accident.	
220.	Outdoors	Recommend establishing SOPs to address the aircraft's sensitivities to weather, including hydraulic seal failures and leakages, freezing moisture, transparencies, air intake, and exhaust protection as necessary.	
221.	T-2 NATOPS Section V Emergencies	Ensure SOPs and training address Section V of the NATOPS, which covers emergencies. Aircraft systems and procedures must be frequently reviewed on a regular basis. Periodic emergency drills are ideally suited for realistic simulation of almost all emergencies that might be experienced.	
222.	Cockpit Familiarization	Recommend instituting detailed and comprehensive SOPs/training (not unlike the military-style training known as "blindfold cockpit check with boldface items" conducted in a cockpit or cockpit simulator) to ensure adequate cockpit familiarization for the PIC.	
223.	Simulated Emergencies	Permit simulated emergencies only in accordance with the NATOPS Flight Manual, including emergency and abnormal checklists and in accordance with the limitations issued by the FAA for the aircraft.	

Issue #	Issue(s)	Recommended Review, Action(s), and Coordination with Applicant	Notes, Action(s) Taken, and Disposition
224.	High-G Training	If operations above 3 Gs are contemplated, recommend the PIC and any occupants receive training, including techniques to mitigate the potential effects of high-G exposure. This is consistent with two 2012 NTSB recommendations stemming form a fatal accident involving a high-performance aircraft.	
225.	Reporting Incidents, Malfunctions and Defects	Ask the applicant/operator to report (to the FSDO or MIDO) incidents, malfunctions, and equipment defects found in maintenance, preflight, flight, and post-flight inspection. This would yield significant safety benefits to operators and the FAA. A 2011 study for the U.S. Navy points to the effectiveness of such practices. It stated: "The data analysis carried out was a comprehensive attempt to examine the strength of the link between safety climate and mishap probability. Our findings would seem to support the premise that safety climate and safety performance are, at best, weakly related. Mishaps are rare events, and they describe only part of the spectrum of risks pertaining to a work system. We suggest that measuring workers' self-reported safety attitudes and behavior is an alternative way to assess the discriminate validity of safety climate." O'Connor, October 2011. In other words, reporting safety issues, such as malfunctions, goes a long way in preventing an accident.	
226.	49 CFR Part 830	Ask the applicant/operator to adopt open and transparent SOPs promoting adherence to 49 CFR Part 830, Notification And Reporting Of Aircraft Accidents or Incidents and Preservation of Aircraft Wreckage, Mail, Cargo, and Records, because there have been so many instances where accidents and incidents are not reported, hindering safety. Occurrences, which are events other than an accident or incident (that requires investigation by the Flight Standards Service for its potential impact on safety) should also be reported. Occurrences include the following when no injury, damage, or § 830.5 reporting requirements are involved: (1) aborted takeoffs not involving a runway excursion, (2) air turnbacks where the aircraft returns to the departure airport and lands without incident, and (3) air diversions where the aircraft diverts to a different destination for reasons other than weather conditions. Refer to FAA Order 8020.11, Aircraft Accident and Incident Notification, Investigation, and Reporting.	
227.	NATO Aviation Safety Guidance	Recommend incorporating the relevant sections of AFSP-1(A), Aviation Safety (NATO, March 2007), into the appropriate aspects of T-2 operations to enhance overall safety. This document, which incorporates many safety issues concerning the safe operation of combat aircraft, sets out aviation safety principles, policies, and procedures—in particular, those aimed at accident prevention. This document is a basic reference for everybody involved in aviation safety, both in occurrence prevention *(*starting from the development, testing, and introduction of material and procedures*)* and its aftermath *(*the determination of the causes of an occurrence and the implementation of measures to prevent its recurrence). It is also recommended that this process include internal safety audits. Safety audits help identify hazards and measure compliance with safety rules and standards. They assist in determining the adequate condition of work areas, adherence to safe work practices, and overall compliance with safety-based and risk-reduction procedures.	
228.	Aircrew Records	Recommend the applicant/operator establish and maintain processes to address aircrew qualifications and records. This could include— • Pilot certification, competency; • Ground and flight training (a) records; (b) instructors; (c) conversion training; (d) command training; and (e) proficiency training; • Medical, duty time, and flight time records.	
229.	Type Clubs or Organizations	Recommend the applicant/operator join a T-2 type club or organization. This facilitates safety information collection and dissemination.	
230.	Emergency Planning and Preparedness	Recommend the applicant/operator institute emergency plans and post-accident management SOPs that ensure the consequences of major incidents and accidents to aircraft are dealt with promptly and effectively.	

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Attachment 4 - Additional Resources and Recommendations

- U. S. Navy/USMC T-2 accident (mishaps) reports.
- T-2 safety articles in U.S. Navy *Approach* publication(s), Naval Aviation Safety Center.
- T-2 safety articles in U.S. Navy *Naval Aviation News* magazine.
- Aviation Safety Reporting System (ASRS).
- *Aviation Safety* AFSP-1(A). NATO, March 2007.
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- CAP 632, *Operation of Permit to Fly Ex-Military Aircraft on the U.K. Register*. This is a comprehensive source of information and guidance on topics like technical requirements, specialist equipment and systems, pilot/crew qualification, operational requirements, records and oversight procedure, and safety management.
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- FAA. AC 150/5300-13, *Airport Design*.
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- *Fixed Wing Aircraft Structural Life Limits,* NAVAIRINST 13120.1.
- *Joint Oil Analysis Program Manual, Volume III: Laboratory Analytical Methodology and Equipment Criteria. (Aeronautical).* (Navy) NAVAIR 17-15-50.3, (Army) TM 38-301-3 (Air Force) TO 33-1-37-3, and (Coast Guard) CGTO 33-1-37-3. July 31, 2012.
- MIL-HDBK-844A, *Aircraft Refueling Handbook for Navy/Marine Corps Aircraft.*
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- NATOPS. NAVAIR 00-80R-14, *U.S. Navy Aircraft Firefighting and Rescue Manual,* October 15, 2003.
- NAVAIR 00-80R-20, *Aircraft Crash/ Salvage Operations Manual,* March 15, 1994.
- NAVAIR 00-80T-109, *Aircraft Refueling NATOPS Manual*, June 15, 2002.
- *Naval Aviation Maintenance Program Standard Operating Procedures* (NAMPSOPs), chapter 10.
- *Naval Aviation Safety Program.* OPNAV Instruction 3750.6 R. Chief of Naval Operations. Washington, D.C., 2007.
- *Naval Safety Center* - A "One-Stop Safety Shop" for Sailors and Marines, *The Hook* (Winter 2008).

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- OPNAVINST 4790.2 and the *Survival Equipment Asset Tracking System Increased Capabilities (SEATS/ICAPS) User's Manual*.
- Safety Regulation Group, Civil Aviation Authority (UK). CAA Document No. 743, *Civil Air Displays: A Guide for Pilots*, 2003.
- USAF T.O. 1-1-691, *Corrosion Prevention and Control Manual.*
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Attachment 5 - Partial Listing of T-2 Accidents and Relevant Incidents

#	Date	Version	Operator	Severity	Probable Cause and Remarks
1.	January 6, 1999	T-2C	USN	Nonfatal	Nose Cone Separated in Flight
2.	June 24, 1997	T-2E	Greek AF	Unknown	Unknown
3.	October 10, 1996	T-2C	USN	Fatal (2)	Unknown
4.	June 24, 1996	T-2E	Greek AF	Fatal (2)	Low Level Stall
5.	March 28, 1995	T-2C	USN	Nonfatal	Mid-Air
6.	July 23, 1994	T-2C	USN	Fatal (1)	Crashed on Take-Off
7.	February 19, 1994	T-2C	USN	Nonfatal	Mid-Air (1st Aircraft)
8.	February 19, 1994	T-2C	USN	Nonfatal	Mid-Air (2nd Aircraft)
9.	May 20, 1993	T-2C	USN	Nonfatal	Overrun
10.	November 25, 1992	T-2C	USN	Nonfatal	Failed Single-Engine Approach
11.	July 22, 1992	T-2C	USN	Fatal (2)	LOC – Failed Ejection
12.	June 4, 1991	T-2C	USN	Fatal (1)	Unknown
13.	May 13, 1991	T-2C	USN	Nonfatal	Engine Failure
14.	October 29, 1989	T-2C	USN	Fatal (5)	Crashed on Deck During Wave-Off on USS Lexington
15.	August 8, 1989	T-2C	USN	Nonfatal	Unknown
16.	July 13, 1989	T-2C	USN	Fatal (1)	Crashed After Take-Off
17.	May 19, 1989	T-2C	USAN	Nonfatal	Fuel Starvation
18.	April 13, 1989	T-2C	USN	Fatal (1)	Mid-Air (1st Aircraft)
19.	April 13, 1989	T-2C	USN	Fatal (1)	Mid-Air (2nd Aircraft)
20.	November 20, 1988	T-2C	USN	Nonfatal	LOC
21.	January 12, 1987	T-2C	USN	Nonfatal	Unknown
22.	October 22, 1986	T-2B	USN	Fatal (1)	Mid-Air
23.	April 25, 1986	T-2C	USN	Nonfatal	Flight Controls Jammed
24.	November 18, 1985	T-2C	USN	Unknown	Unknown
25.	June 20, 1985	T-2C	USN	Fatal (1)	Night Flight
26.	January 11, 1985	T-2C	USN	Fatal (2)	Unknown
27.	November 14, 1984	T-2C	USN	Fatal (1)	Crashed After Takeoff
28.	August 30, 1984	T-2C	USN	Unknown	In-Flight Explosion
29.	July 28, 1983	T-2E	Greek AF	Unknown	Unknown
30.	July 9, 1982	T-2C	USN	Unknown	Crashed on Approach
31.	October 27, 1980	T-2C	USN	Unknown	Unknown
32.	December 4, 1979	T-2C	USN	Unknown	Unknown
33.	March 2, 1978	T-2C	USN	Unknown	Unknown
34.	August 26, 1977	T-2C	USN	Unknown	Unknown
35.	July 8, 1977	T-2E	Greek AF	Unknown	Unknown
36.	September 17, 1976	T-2C	USN	Unknown	Unknown
37.	September 29, 1974	T-2D	Venezuelan AF	Fatal (4)	LOC – Crashed Into Residences
38.	July 28, 1971	T-2A	USN	Unknown	Unknown
39.	November 1965	T-2A	USNB	Nonfatal	Engine Failure (Sen. McCain)

40.	February 17, 1967	T-2A	USN	Unknown	Unknown
41.	January 20, 1960	T2J-1	USN	Unknown	Mid-Air (1st Aircraft)
42.	January 20, 1960	T2J-1	USN	Unknown	Mid-Air (2nd Aircraft)
43.	September 23, 1959	T2J-1	USN	Unknown	Unknown
44.	September 9, 1959	T2J-1	USN	Unknown	Unknown
45.	May 9, 1959	T2J-1	USN	Nonfatal	Unknown (Ejection)
46.	May 4, 1959	T2J-1	USN	Unknown	Unknown


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